

POLYCHAETOUS ANNELIDS

PART VII. CAPITELLIDAE

(PLATES 43-58, 1 CHART)

By OLGA HARTMAN

This constitutes one of the oldest known groups of polychaetous annelids; it was already known in the late seventeen hundreds through the species *Capitella capitata* (Fabricius). The affinities of the group with other polychaetous annelids, however, were not clarified until detailed anatomical studies of organ systems had verified and proved their true relations. They had been variously considered as oligochaetes, representatives of Maldanidae, Arenicolidae, and Serpuliformia even as late as 1865 (see Eisig, 1887, pp. 1-10, for detailed history).

The family name was first erected as the Capitellacea by Grube (1862) when *Notomastus*, *Dasybranchus*, and *Capitella* were correctly grouped together. A year later the family name, Halelminthea Carus, was proposed for *Capitella*, but this author considered it in the Oligochaeta together with an opheliid, *Polyophtthalmus*; the name Halelminthea now has only historical interest. Today the various genera and species of Capitellidae (see below) are indisputably considered distinct, forming a closely related family; their affinities are with other sedentary chaetopods.

Externally and grossly considered, many capitellids resemble terrestrial oligochaetes because of their plain, unadorned exterior. In details, however, the body is seen to consist of a distinct prostomial lobe, a thorax with a limited number, and an abdomen with a variable number of segments. The thorax and abdomen, though distinct from each other, are sometimes indivisible in external view or are separate from each other by transitional segments (pl. 58, fig. 1). The prostomium is a plain, short, rounded (pl. 55, fig. 1) or elongated (pl. 47, fig. 4) lobe, without eyes (pl. 50, fig. 4) or with a pair of pigmented areas (pl. 47, fig. 4) at the sides. A pair of eversible nuchal organs or ciliated mounds, homologous with the lateral organs farther back, is more or less conspicuous at the posterior margin of the prostomium, or may be reduced nearly to dis-

appearance. When retracted these organs appear externally as elongate slits (pl. 47, fig. 4); when everted they are sacklike, ciliated mounds.

The proboscis is a soft, eversible part of the anterior end of the alimentary tract. When everted it is globular to somewhat lobed (pl. 50, fig. 1); its surface may be smooth to more or less strongly papillated, especially in its proximal part; the separation between the 2 regions is sometimes abrupt. The proboscis functions in locomotion and for food ingestion.

The thorax consists of a definite number of segments, ranging from only 9 (*Capitella*, see below) to as many as 19 or 20 (*Anotomastus*, new genus, see below). The first visible segment or peristomium may be achaetous and apodous (*Notomastus*) or it may resemble those farther back (*Capitella*). The first setigerous segment may be complete with both notopodia and neuropodia (*Heteromastus*) or neuropodia may be absent (*Leiocapitella*, new genus); all other parapodia are biramous. Thoracic parapodia are provided with only simple pointed setae (*Notomastus*), or also hooded hooks (*Heteromastus*), or also specialized genital hooks (*Capitella*). Abdominal parapodia are provided with only simple hooded hooks (*Notomastus*), or also slender pointed setae (*Proto-capitella*), or also specialized spines (*Scyphoproctus* and *Pulliella*).

Branchiae are absent (*Capitella*), or present on the abdomen as non-eversible modifications of notopodia or neuropodia (some species of *Notomastus* and *Heteromastus*), or they may be eversible sacks or lobes from either notopodia (*Heteromastus magnus*, new species) or neuropodia (*Dasybranchus lumbricoides* Grube).

Lateral sense organs (pl. 50, fig. 1) are seemingly absent (pl. 45, fig. 1) in some (*Capitita*, new genus), or limited to thoracic and anterior abdominal segments (*Heteromastus*), or present throughout (*Dasybranchus*). On the thorax they are eversible, on the abdomen stationary, papillae. They are usually to be found on, or near, or along the parapodial ridge located between notopodia and neuropodia. Like the nuchal organs, they are ciliated mounds without aperture but provided with neural innervation and muscular connections. They probably function in sensory detection.

Nephridia, sometimes though perhaps incorrectly called segmental organs (since they do not occur on all segments), open externally by a pore and internally through a nephrostome into the coelomic cavity. Their presence or stage of development in immature through adult stages is usually variable since the constituent parts change during ontogeny. In

some species nephridia may be present in young individuals and later undergo retrogression to disappearance in certain segments. Furthermore, they may be present on some abdominal segments or some thoracic segments, or some segments in both thorax and abdomen. When immature or only partly developed, they are sometimes distinguished with difficulty. On the other hand, in sexually mature individuals, where they come to be modified as genital pores, they may be very conspicuous (pl. 50, fig. 5). On the thorax the nephridial pore is often in the segmental groove at the sides of the body (pl. 47, fig. 1); on the abdomen it takes various positions depending on the species, but it is usually in the vicinity of parapodia or lateral organs, when present. In some species (*Capitella*) nephridia are polymeric on some abdominal segments; the apertures are in the epithelium and not easily visible in external view (see Eisig, 1887, p. 272).

A closed circulatory system is absent in the capitellids. The ventral chamber of the coelom substitutes as a haemocoel. The various parts of the coelom (visceral, branchial, and gonadial chambers) are in communication with one another through definite openings. The circulatory fluid moves in the coelom with the lymph and is freely mixed with the gonadial products, but rhythmic contraction insures that the blood circulates in the branchiae, prostomium, and other terminal parts (see also Haffner, 1930, p. 136). The circulatory fluid is red owing to the presence of corpuscles.

Modifications of body parts are less marked in the capitellids than in most chaetopods. The prostomium, peristomium, and thorax are typically plain. Parapodial ridges or parts of the surface epithelium may be modified as special structures to function for respiration and for glandular secretion. In some species there are extensile, filamentous (pl. 51, fig. 4) or tufted (pl. 50, fig. 6) prolongations functioning as branchiae; they may be stationary (pl. 58, fig. 6) or retractile (pl. 55, fig. 4) and are usually near the parapodial ridges on some abdominal segments. In some others the pygidium may be modified as a caudal appendage (pl. 45, fig. 4) presumably for respiration, reminiscent of a similar structure in some aquatic oligochaetes.

The specific character of the hooded hooks or uncini is of particular significance because of the repetition of these parts through most body segments and their striking constancy throughout the segments of an individual and among the individuals of a species. In all instances where these details have herein been carefully worked out, it is found that these hooks are not only highly specific (contrary to the opinions of some

previous statements) but so different extra-specifically as to be one of the finest means of speciation that has been discovered. This specificity is to be noted not only in the arrangement of the crest and fang, but also in the structure of the hyaline sheath or hood and the details of the shaft (see below).

At this point it is expedient to discuss the conclusions of the only exhaustive study that has yet been made of these hooded hooks and their microscopic structure. Eisig (1887, pp. 104-106) using *Notomastus* (*Clistomastus*) *lineatus* (see below) and generalizing on several other species, stated in part:

“nicht nur sind die Haken der verschiedenen Körperregionen einer gegebenen Species unter sich von grösster Aehnlichkeit, sondern auch die Unterschiede derselben in den verschiedenen Species sind überaus geringfügig [?]. Hierzu kommt noch, dass die Hakenköpfe [beaks] bezüglich der Zahl, Form und Grösse ihrer Zähnnchen in allen Individuen eine gewisse Variabilität zeigen [?], und endlich hat man mit dem Factum zu rechnen, dass in Folge der S-förmigen Krümmung, sowie des prismatischen Querschnitts der Haken, selten Bilder von genau gleich orientirten Exemplaren zu Gesicht kommen [very true].” Furthermore, “Die Haken . . . stellen sich in der Profilansicht als rundliche, in der Mitte leicht angeschwollene Stäbe dar [the shaft with node], deren Basis sichelförmig und deren freies Ende vogelkopffartig gekrümmt endet [the beak with major fang and crescent of teeth]; dem letzteren Ende sitzen überdies mehrere, meist drei, spitze Zinken auf, von denen der unterste [fang] der grösste zu sein pflegt. Untersucht man die Haken . . . auch in der Flächenansicht, so findet man, dass den erwähnten drei übereinander geordneten Zinken in Wirklichkeit drei Reihen [but see below] solcher entsprechen . . . Jede dieser Reihen enthält 7-10 Zinken, so dass deren in Ganzen etwa 20-30 vorhanden sein mögen [?]. An Stelle der bei den Pfriemen vorhandenen Säume werden die Haken, und zwar deren Köpfe, von dünnhäutigen, an ihrer concaven Seite geöffneten Hauben [hoods] umhüllt, welche Gebilde wahrscheinlich nur beim Durchbrechen der Hypodermis eine Rolle spielen [?], indem sie bei den ausgebildeten Haken häufig fehlen, oder doch nur unvollkommen erhalten sind [but see below] . . . Man findet sie bald fest mit dem Hakenkopfe verwachsen, bald weit von ihm abstehend; in den meisten Fällen ist ihr Rand glatt, zuweilen aber erscheint er auch mit einer ähnlichen Zähnnchenreihe besetzt, wie der Hakenkopf selbst deren mehrere besitzt.”

Contrary to the view expressed above, regarding the function of the hood (that is, that it probably protects the teeth and fang as the newly developed hook emerges from the hypodermis of the parapodium and that it is thereafter more or less completely shed), it now seems more likely that the functioning may be somewhat as follows. The hood (when present) probably persists normally throughout the existence of the hook. It is composed of a resilient membrane in one piece with distal aperture and a long slit along the distal end of the hooked side (pl. 43, figs. 1, 2). The distal oval aperture is more or less delicately serrated at its margin and is capable of being somewhat compressed in line with the cleft, when the hooks of a series are withdrawn into the parapodium so that the beak is covered. On the other hand, when the parapodium is extended and the uncinal torus is pushed outward, the separate hooks are pushed apart, allowing the tension on the hood to be released and the distal aperture to be spread apart, exposing fang and crest. The hooks function, perhaps, to gain traction as the individual moves up and down in the tube or burrow. When the parapodium is retracted, the protecting hood is drawn firmly about the beak. Foreign particles, such as silt and fine sand grains, are seldom seen in the hood; it may be assumed that another function of the hood, by reason of its flexibility and structure, is to keep the parts of the hook free from debris.

Only one species has been found in which a hood is totally lacking, both in immature, embedded hooks and in fully formed functioning hooks (pl. 57, fig. 4), but this species, *Protocapitella simplex* (see below), is unusual in other respects also.

Fundamentally, the structure of the hooks is as stated by Eisig. However, no instance has been found, among the hooded hooks examined, in which there are actually several rows of teeth, with as many as 7 in each; in a few instances there is a tendency for the teeth in a single row to pile on one another (pl. 52, fig. 1); rarely they are in several rows (pl. 58, fig. 3). Most commonly they are in a single transverse row that may be slightly arched or crescentic.

When the hooks are examined for their true 3-dimensional relations, great care must be used in properly orienting them since the usual position assumed when a series is dissected away from the body is for the individual hooks to lie in partial three-fourths view. This is so not only because they are connected with one another by common membranes, but also because the shaft and beak are usually so constructed that lateral and frontal views are seldom seen. Furthermore, the high magnifications

(usually oil immersion) required to discern these 3-dimensional objects implies that usually only thin optical sections are seen at any one time. A single, long, curved tooth can thus be made to resemble several teeth in ascending series by merely changing the depth of focus. Also, since the hooks are highly translucent, any superimposed or underlying objects can further distort the true outlines. The minuteness of these structures enhances the possibility of aberration or misinterpretation. The smallest species discussed below, (*Capitita ambiseta*, new species), has hooks in which the beak is only about 2 micra across; a single tooth, of which there are 3 in a row, thus measures less than one micron across.

The microscopic details of these hooks have been carefully worked out and illustrated for 19 species (see below). The parts of a hook are herein designated as follows (pl. 43, figs. 1, 2). The long embedded stem is the *shaft* with the *node* near its middle length. It extends distally, often forming a thickened *shoulder* with a slender *neck* and terminates distally in a hooked *beak* provided with a larger *fang* surmounted by a *crescent* composed of smaller *teeth* or *denticles*. The beak is more or less loosely vested with a hyaline *hood* or sheath (rarely absent, in *Protocapitella*); this is capelike, with an oval *aperture* distally to allow for the protrusion of the teeth; the aperture is continued basally as a *cleft* that extends nearly to the basal end of the hood. The hooks are translucent yellow to slightly brownish, and the hood is translucent yellow in all instances where these parts have been examined.

The slender pointed setae are provided with a pair of limbate wings at their end. These wings are probably homologous with the hyaline hood of the uncini (see also Eisig, 1887, p. 105). The modified genital hooks of *Capitella* and the terminal acicular spines of *Scyphoproctus* are perhaps transformed pointed setae rather than hooks. Specialized setae or hooks may function as holdfast organs (*Scyphoproctus* and *Pulliella*) or for reproduction (*Capitella*). Some of the terminal segments may be modified to form an anal plaque or funnel (*Heteromastides* and *Scyphoproctus*).

Sexes are separate, but sexual dimorphism is not conspicuous. In a few cases (*Capitella*) the presence of specialized spines in posterior thoracic segments distinguishes the two sexes. Copulation is known to occur (*Capitella* and *Notomastus*), but artificial fertilization is possible (see Wilson, 1935, p. 512). In some species ova are extruded through modified nephridial apertures (*Dasybranchus*). On the other hand, in some other species (*Clistomastus*) it is likely that autotomy of posterior

abdominal segments is the only means for release of ova and sperm, since nephridial apertures are either absent or restricted to a few anterior segments (see also Eisig, 1887, pp. 794-795).

Little is known of normal development except for two species, *Capitella capitata* (Eisig, 1898) and *Notomastus latericeus* (Wilson, 1933). In the first of these the adult exercises brood care until the young larvae swim away. In both species the young pelagic trochophore develops into a typical polytrochal larva and passes through the metamorphosing, settling stage into a sedentary, limicoline adult.

Most capitellids are stenohaline, limited more or less strictly to marine habitats. A few are euryhaline; *Capitella capitata* (Fabricius) and *Notomastus (Clistomastus) tenuis*, new combination (see below), are common in estuaries and can withstand flooding by rains. Freshwater inhabitants occur rarely, as *Eisigella ouanaryensis* Gravier from French Guiana. In their known bathymetric ranges capitellids are unique; they occur most commonly in intertidal and littoral zones, especially in mud flats, but their vertical distribution extends through neritic zones to abyssal depths; the deepest known record is that of *Notomastus agassizi* (McIntosh, 1885, p. 389) dredged off New York in 1,340 fms.

The phylogenetic affinities of the Capitellidae are obscure. Systematically they are generally considered between the Opheliidae and Arenicolidae (Eisig, 1887, p. 891 and Fauvel, 1927, p. 139), but in the structure of the characteristic hooded hooks they are likewise allied to the Maldanidae. There are no known living representatives of capitellids that readily ally them to one or the other of these related families. *Inter se* they are a distinct group, with a characteristic combination of parts, including the short, plain, prostomial lobe, the eversible, sacklike proboscis, the inflated thorax that is more or less sharply set off from the abdomen, the characteristic parapodia with their unique hooks; additional features include the absence of a closed circulatory system and the almost universal presence of lateral organs.

Distribution.—The rare occurrence of capitellids in large collections is noteworthy and has been commented on by others (see also McIntosh, 1885, p. 388). The *Challenger* Expedition, on its voyage around the world (1871-73), reported 2 species and 2 unidentified fragments. Chamberlin (1919a) recorded a fragment from the various collections of the U.S.S. *Albatross* during four extensive voyages (1884-1909) in various parts of the Pacific and Atlantic Oceans. Ehlers (1887) described one species in the collections of the *Blake* from the

West Indian region. Augener (1927) recorded one species from southern and southeastern Australia. On the other hand, Fauvel (1927) described 13 species in 9 genera in the fauna for western and southern France; Fauvel again (1932, pp. 192-198) reported 7 species in 6 genera from India; and Annenkova (1938, p. 89) reported 5 species in 3 genera from the Japanese Sea. Furthermore, the collections of the Allan Hancock Foundation of The University of Southern California include representatives of 18 species in 10 genera of which 14 species originate from California and Lower California, one from Oregon, 3 from eastern United States, and one from England. In addition, *Notomastus luridus* Verrill has been made available from Yale University. The total number of species consulted numbers 19 and 4 others are reviewed (see the following list).

It is largely to the credit of the facilities and the operations of the *Velero III* under the able command of Captain Allan Hancock that these valuable materials have been obtained. It is a pleasure and privilege to acknowledge thanks and support to the Administration of The University of Southern California and the Direction of the Allan Hancock Foundation for permission to study these unusual and interesting materials. I wish to express thanks also to the personnel of the Peabody Museum of Natural History, Yale University, for the loan of valuable materials.

The preparation of the plates for the capitellids has been unusually well performed by the staff artist, Mr. Anker Petersen, whose skill and workmanship have resulted in careful delineation of characters such as has never been attempted heretofore for this difficult and little-known group. The highly magnified details of significant setal structures have been worked out with great patience and accuracy in their true 3 dimensional relations resulting in discoveries that had not been surmised previously. These characters are amplified under each species discussed. To Miss Dolores Hahn I extend thanks for aid in typing copy.

LIST OF SPECIES

(Those preceded by an asterisk could not be examined for this report.)

1. *Capitella capitata* (Fabricius)
2. *Capitella dizonata* Johnson
3. *Capitella ovincola*, new species
4. *Mediomastus californiensis* Hartman

5. *Capitita ambiseta*, new genus, new species
- *6. *Notomastus giganteus* Moore
7. *Notomastus magnus*, new species
8. *Notomastus lobatus*, new species
9. *Notomastus (Clistomastus) lineatus* Claparède
10. *Notomastus (Clistomastus) tenuis* Moore
11. *Notomastus (Clistomastus) luridus* Verrill
12. *Notomastus (Clistomastus) hemipodus*, new species
13. *Heteromastus filiformis* (Claparède)
14. *Heteromastus filobranchus* Berkeley
- *15. *Leiochrides pallidior* (Chamberlin), new combination
16. *Dasybranchus lumbricoides* Grube
17. *Dasybranchus lunulatus* Ehlers
18. *Dasybranchus glabrus* Moore
19. *Dasybranchus platyceps*, new species
20. *Leiocapitella glabra*, new genus, new species
21. *Protocapitella simplex* Berkeley
22. *Anotomastus gordiodes* (Moore), new genus, new combination
- *23. *Eunotomastus grubei* McIntosh

All of the collections including holotypes and paratypes are deposited in the Allan Hancock Foundation of The University of Southern California.

The number of known genera of Capitellidae is 21 ; in addition, 3 are newly erected herein, bringing the total to 24. Among these only 7, or less than one-third, were treated in a voluminous monograph of the family (Eisig, 1887, pp. 1-906), but this study was concerned with only 10 species in 6 genera from the Mediterranean Sea. Most of the other species and genera have since been newly described and many remain known only through original accounts scattered in many articles and journals. Furthermore, 17 of the 24 genera are monospecific, so that the total number of species for the family is still small (only about 49 species are generally recognized). One genus, *Eunotomastus* McIntosh (1885) is too incompletely known to incorporate in the chart.

The known genera with species and approximate distribution are listed below, in alphabetical order.

Barantolla Southern (1921) with one species, *B. sculpta* Southern from India.

Branchiocapitella Fauvel (1932) with one species, *B. singularis* Fauvel from India.

Capitella Blainville (1828), with 2 species.

Capitellethus Chamberlin (1919) with one species, *C. dispar* (Ehlers) from the Indo-Pacific.

Capitellides Mesnil (1897) with one species, *C. giardi* Mesnil from France, and another, *C. teres* Treadwell (1930) from Texas, of doubtful systematic position.

Capitomastus Eisig (1887) with one species, *C. minimus* (Langerhans) from Europe.

Dasybranchus Grube (1850) with about 8 species.

Dasybranchethus Monro (1931) with one species, *D. fauveli* Monro from the Great Barrier Reef, Australia.

Eunotomastus McIntosh (1885) with one species.

Heteromastides Augener (1914) with one species, *H. bifidus* Augener from southwestern Australia.

Heteromastus Eisig (1887) with 3 species.

Leiochrides Augener (1914) with 3 species.

Leiochrus Ehlers (1912) with one species, *L. alutaceus* Ehlers from off Sumatra.

Mastobranchus Eisig (1887) with 3 species, *M. dollfusi* Fauvel (1936) from Maroc, *M. indicus* Southern (1921) from India, and *M. trinchessii* Eisig (1887) from the Mediterranean Sea.

Mediomastus Hartman (1944) with one species.

Notomastus Sars (1851) with 3 (possibly 2) subgenera and about 17 species, including:

Clistomastus Eisig (1887) with 2 species.

Eisigella Gravier (1901) with one species, *E. ouanaryensis* Gravier from French Guiana. [This may be the same as *Clistomastus*].

Notomastus with about 14 species.

Parheteromastus Monro (1937) with one species, *P. tenuis* Monro from Burma.

Protocapitella Berkeley (1932) with one species.

Pseudocapitella Fauvel (1913) with one species, *P. incerta* Fauvel from Europe.

Pulliella Fauvel (1929) with one species, *P. armata* Fauvel from the Gulf of Manaar, India.

Scyphoproctus Gravier (1904) with 2 species, *S. djiboutiensis* Gravier from the Red Sea, and *S. gravieri* Okuda (1940) from Japan.

[*Isomastus* Gravier (1911, p. 312) is here regarded the same as *Capitella*, as already suggested by Augener (1932), p. 44.]

In addition, new species are described as follows; one in *Capitella* and 3 in *Notomastus*; also 2 new species in 2 new genera are erected, and a new generic name is proposed for a previously described species. These are:

Capitella ovincola, new species

Capitita ambiseta, new genus and species

Notomastus magnus, new species

Notomastus lobatus, new species

Notomastus hemipodus, new species

Leiocapitella glabra, new genus and species

Dasybranchus platyceps, new species

Anotomastus, new genus for *Eunotomastus gordiodes* Moore

The total number of genera is 24. Seventeen are known for a single species only; they are *Anotomastus*, *Barantolla*, *Branchiocapitella*, *Capitellethus*, *Capitita*, *Capitomastus*, *Dasybranchethus*, *Eunotomastus*, *Heteromastides*, *Leiocapitella*, *Leiochrus*, *Mediomastus*, *Parheteromastus*, *Protocapitella*, *Pseudocapitella*, *Pulliella*, and possibly also *Capitellides*.

A chart has been used instead of a key for the Capitellidae to facilitate the identification of the various genera. For this purpose the following scheme is inserted. The outlines represent anterior ends of capitellids that are schematically shown in left lateral view with the prostomium at the left end. Grouping is by number of segments in the thorax, ranging from 9 in the first to 20 in the last. The letter *S* represents long pointed setae, *H* represents long-handled hooks, and *G* represents genital hooks. In 2 genera, *Capitella* and *Capitomastus*, the arrangement of these parts differs slightly in the 2 sexes, as indicated. In *Anotomastus*, on the other hand, the first appearance of hooks varies slightly between individuals, regardless of sex. In *Capitellethus* the presence of setae in the peristomium is not certain, hence the *S* is preceded by a question mark. In *Capitita*, a middle abdominal region is characterized by the reappearance of setae with hooks, and far posterior segments have only single long setae in notopodia. The presence or absence of branchiae is shown where known, but this character may have little generic significance. The separation between thorax and abdomen, if distinct, is indicated by a heavy vertical line; if weak or transitional, a wavy line is used. The specific characters are taken up in greater detail for the species concerned.

Genus **CAPITELLA** BlainvilleType **C. capitata** (Fabricius)

The thorax consists of 9 segments, of which the first 7 have pointed setae; hooded hooks are present in posterior thoracic segments, sometimes accompanied by pointed setae or completely replacing them. Acicular genital hooks replace the hooded hooks in the eighth and ninth notopodia of male individuals. Rarely there are also a few pointed setae in the eighth segment but their appearance may be irregular. Abdominal parapodia are provided with only hooded hooks. The prostomium is an inconspicuous lobe that lacks eyes; the nuchal slits are weakly developed. Lateral organs are absent and genital apertures are limited to the last few thoracic segments. There are no specialized branchiae. Nephridia are polymeric in some abdominal segments; they open into the epithelium and have no distinct external aperture.

Two species have been reported from the Western Hemisphere: they are the cosmopolitan species, *C. capitata* (Fabricius) and *C. dizonata* Johnson, from Washington (see below). A third species, *C. ovincola*, is herein described as new.

Isomastus Gravier (1911) is perhaps only a subgenus of *Capitella* (see Augener, 1932, p. 44) if not congeneric; it is distinguished from *Capitella* only in that setae as well as hooks may be present in the eighth or also the ninth segment.

KEY TO SPECIES

1. Notopodia of eighth and ninth segments lack setae or hooks in female individuals *C. dizonata*
1. Notopodia of all segments provided with setae or hooks 2
2. Notopodia and neuropodia of sixth and seventh segments or already neuropodia of fifth segment with both capillary setae and hooded hooks; abdominal segments long, length equals nearly 3 times width; abdominal parapodial ridges elevated (pl. 44, fig. 6) *C. ovincola*
2. Parapodia of sixth or also seventh segments with pointed setae only; abdominal parapodial ridges much less elevated. *C. capitata*

Capitella capitata (Fabricius)

Plate 43, Figs. 1,2

Fauvel, 1927, pp. 154-155, fig. 55; Berkeley, 1929, p. 312; MacGinitie, 1935, p. 693.

Collections.—Many individuals come from Oregon south to southern California from intertidal zones; others are from San Francisco and Mission Bays, California.

The details of the hooded hooks in abdominal segments are shown in plate 43, figs. 1 and 2. Node, shoulder, and neck are easily distinguished. The fang is surmounted by a crest of 3 teeth in a straight row; the teeth are well separated from one another.

Distribution.—This species is common in black sandy beaches in quiet water; it sometimes occupies beds of considerable extent, especially in estuarine or also brackish water. The surface mark of the vertical burrow is a tiny black cinder cone. Sexually mature individuals are surrounded by a debris-covered tube in which the eggs are laid and early development occurs.

Capitella ovincola, new species

Plate 44, Figs. 1-6

Collection.—Monterey Bay, California, in 30 to 40 fms, from squid egg mass, June 8, 1931 (many), collected by Mr. G. E. MacGinitie.

The general form is slender, elongate; total length of a larger and perhaps mature individual is about 60 mm. In individuals of both sexes the first 4 segments are smooth except for shallow longitudinal wrinkles; they resemble those farther back. Segments 5 to 9 have a longitudinal groove midventrally and lesser furrows at the sides. Abdominal segments are long and have raised, glandular parapodia.

The prostomium is a depressed conical lobe that is longer than wide; it lacks eyespots and the nuchal slits are inconspicuous. The first segment has spreading fascicles of capillary setae in both notopodia and neuropodia; the next 4 segments are similar or the fifth segment has some hooks in the neuropodia. From the sixth segment the 2 superiormost setae in notopodia and the 4 inferiormost ones in neuropodia may be replaced by hooded hooks that resemble those farther back; they are accompanied by 16 to 20 pointed setae. The seventh segment is similar to the sixth one except that there may be an even greater replacement of hooks for pointed setae especially in the neuropodia. In female individuals the eighth and ninth segments are provided with long-handled, hooded hooks only; they are arranged in a single row in each fascicle. The ninth segment has about 18 hooks in each neuropodium. In male individuals notopodia in the eighth and ninth segments are replaced by specialized genital hooks; the eighth segment has 4 or 5 pairs, the ninth has 3 or 4

pairs. These hooks are deep yellow, somewhat flattened and slightly falcate distally; they show very few indications of cross striations and notably less than those in *C. capitata* (Fabricius). Those in the eighth segment are slenderer than those in the ninth one.

Anterior abdominal segments are biannulate and longer than wide; at the eighth one they are nearly 3 times as long as wide and they continue proportionately long to the posterior end of the body. Interparapodial nodes are transversely wrinkled as though capable of great extension in life. Abdominal parapodia are located near the posterior margin of the segment. Notopodia and neuropodia are well separated from each other; the neuropodial ridge is typically the longer. These ridges are thick, glandular and opaque white; the posterior portion is thicker and more elevated than the anterior one. In segments far back the posterior flange forms a neat, thick crescent behind and around the uncinial ridge.

Genital pores resemble those in *C. capitata* (Fabricius); in the female they form a pair of elongate, oval, opaque white areas at the sides of the body and they are located on the seventh and eighth segments.

Abdominal hooks are long shafted and terminate in a beak that is covered over with a delicate hood. The major fang is long and nearly at right angles to the shaft; it is surmounted by 4 (or rarely 5) fine teeth in a transverse row. The hyaline hood extends only slightly beyond the distal teeth. The shaft has a conspicuous asymmetrical node. The fibrillations extend basally to the end but distally only to the neck. Shoulder and neck regions are clearly marked.

The posterior end tapers to a narrow ring and ends in a small collar-like pygidium with a mid-dorsal notch; there are seemingly no terminal appendages.

C. ovincola is known to occur only in the gelatinous lobed egg masses of squid; it forms compact clumps in the egg jelly; in June various stages of development to maturity are present. Individuals are irregularly intertwined with one another but each is sheathed in a thin, flexible, chitinous layer; there is no distinct tube or burrow.

C. ovincola differs from *C. capitata* grossly in being noticeably larger and having greatly prolonged abdominal segments. Abdominal parapodia are thicker and larger than those in *C. capitata*. Hooded hooks may accompany setae in the sixth and seventh setigerous segments or be present already in the fifth one. Genital hooks number 4 or 5 pairs in the eighth segment and 3 or 4 pairs in the ninth one. Abdominal hooks have 4 or 5 teeth above the fang instead of only 3. The 2 species differ

widely in the nature of their habitat; *C. ovincola* is known only from squid egg masses whereas *C. capitata* inhabits fine black silt in littoral zones.

I am indebted to Mr. and Mrs. G. E. MacGinitie for the collection on which this species is based.

Holotype.—AHF no. 118; paratypes in the Allan Hancock Foundation.

Type locality.—Monterey Bay, California, in 30 to 40 fms, in gelatinous masses of squid eggs.

Distribution.—Monterey Bay, California.

***Capitella dizonata* Johnson**

Johnson, 1901, pp. 415-416, pl. 11, figs. 119-121.

No collections are available, and the type and only known specimen is not known to exist. The species was described from a single, incomplete individual, presumably an immature female that was collected from intertidal zones at Port Orchard, Washington. The original and only account (Johnson, 1901, pp. 415-416, pl. 11, figs. 119-121) is not clear on all points. The first 7 segments have pointed setae only, and such setae are continued posteriorly in notopodia through at least the first abdominal segment but are thereafter replaced by hooks. However, according to the account "dorsal setae of the eighth and ninth somites appear to be entirely wanting." There are thus 7 segments with setae above and below, followed by 2 segments lacking notopodia but having hooks in neuropodia; the first abdominal segment has setae in notopodia and hooks in neuropodia.

If these stated characters are typical, *C. dizonata* is at once distinct from other species of the genus even though additional details are lacking. It may be suggested, however, that if the description was actually based on an immature male individual in which the modified genital hooks of the eighth and ninth segments either had not yet developed or had been retracted, the species may prove to be conspecific with another known form, possibly *Capitella capitata* (see above). The uncertainty seems difficult to clarify unless the holotype or topotypes can be examined.

Genus *MEDIOMASTUS* Hartman

Type *M. californiensis* Hartman

The thorax consists of 11 segments, of which the first lacks parapodial parts; segments 2 to 5 have pointed setae only and segments 6 to 11 are

provided with hooded hooks only. The abdominal segments have only hooded hooks throughout. Special branchiae are wanting. Lateral organs are present from the first setigerous segment and probably continued throughout. Nephridial apertures are few, limited to posterior thoracic segments. The proboscis is epithelial, it is papillated on its proximal portion and smooth distally. A single species is known.

Mediomastus californiensis Hartman

Plate 46, Figs. 3, 4

Hartman, 1944, p. 264.

Collections.—Numerous individuals come from central California and Oregon, in intertidal zones.

Lateral organs are present from the first setigerous segment and are continued throughout the thorax; they are located between notopodia and neuropodia and slightly nearer the former. They are continued through abdominal segments in a similar position, but are sometimes difficult to distinguish because of their small size. Nephridial apertures number only 3 pairs; they are first present in the segmental groove between the seventh and eighth, and are continued back to the ninth and tenth, setigerous segments. None have been identified in the abdomen. Genital apertures are seemingly absent.

Hooded hooks have a closely fitting hood with a small aperture. The shaft is thick and compact with a gently sloping node. Shoulder and neck regions are well defined. On the beak the fang is thick, strong, and surmounted by 3 well-separated teeth arranged in a triangle as seen in frontal view. The fibrillations of the core extend from the base distally to the beak.

Distribution.—This is known to occur commonly in intertidal, estuarine zones from Oregon south to central California. It inhabits muddy sand that is fairly compact and fine in composition.

Genus **CAPITITA**, new genus

Type **C. ambiseta**, new species

Pointed setae and hooded hooks are present in both thorax and abdomen. The first segment is apodous and achaetous; the second to fifth segments are provided with only pointed setae in both notopodia and neuropodia. The sixth to tenth segments have only hooded hooks that resemble those farther back. The eleventh segment is transitional; its parapodia are provided with only hooks. In the abdomen the first 8 to 16

segments are provided with hooded hooks only; thereafter neuropodia have hooks only but the notopodia have both pointed setae and hooks; far posterior notopodia have pointed setae only. There are no visible branchiae, lateral organs or nephridial apertures. The posterior end terminates in a long caudal tail.

Capitita differs from nearly related genera in that median and posterior notopodia are provided with both hooks and pointed setae (pl. 45, fig. 4).

***Capitita ambiseta*, new species**

Plate 45, Figs. 1-4

Collections.—1442-41 (about 6); 1445-42 (many); 1451-42 (4).

There are numerous tiny, adult or mature individuals; the general form is minute, threadlike, the entire length is only 12 to 15 mm and width is about 0.5 mm. Total number of segments is about 70. In life the body is purplish red as in most other capitellids; preserved it is pale. The surface epithelium is smooth except for segmental grooves (pl. 45, fig. 1). Separation between the thorax and abdomen is not sharp, but the abdomen is slightly wider than the thorax in its posterior portion and the alimentary tract widens in the latter region (to be seen in translucent individuals in life).

The prostomium is slightly flattened and tapers anteriorly to a short palpode; it lacks visible pigment or eyespots. Nuchal slits have not been identified. The partly everted proboscis is globular, its surface covered with low papillae. The first segment or peristomium is smooth and longer than those following. Segments 2 to 5 are provided with notopodial and neuropodial fascicles of pointed setae. The first setigerous segment has 4 or 5 setae above, 3 to 5 below; the second has 5 or 6 setae above and about the same number below; the third has 6 above and about 5 below; the fourth has as many or more. The next 5 segments are provided with only long-handled, hooded hooks in both notopodia and neuropodia; they number 6 to 11 in a fascicle and resemble those in the abdomen. The eleventh segment seems to be transitional in that in its length it compares with those in front, but in the position of its parapodia it is like those in back.

In the abdomen, anterior notopodia through 8 to 16 segments are provided with only hooded hooks; thereafter, the superiormost hook in a fascicle is replaced by 1 or 2 slender, pointed setae. In about the last 25 notopodia hooks are seemingly absent; a single, longer slightly curved seta

projects from the fascicle. Abdominal neuropodia are similar throughout in that they are provided with only hooded hooks; the ridges in anterior and median segments are longer and less conspicuously raised than those farther back, but the change is gradual.

There are no special parapodial respiratory organs, but in life the blood may be observed passing in and out of the long caudal appendage; respiration may be partly accomplished in this way. The body tapers gradually and terminates in 2 smooth rings that lack setae; they are followed by the caudal ring and ventral appendage. The anal aperture is dorsoposterior and immediately above the base of the thick, digitate tail. When completely retracted, the tail has the appearance shown in plate 45, fig. 4; in life it is capable of great extension such that its length may exceed that of the last 10 segments.

Abdominal hooded hooks are unique in having a slender shaft proximal to the node; they increase in thickness abruptly at the node and again in the hooded portion. The hood is voluminous and has a large aperture. The fang is long, curved, and surmounted by 3 well-separated teeth in a straight transverse series.

Capitita ambiseta inhabits soft silty mud flats in estuaries where it forms beds. Individuals are surrounded by closely fitting tubes of fine debris and mucus; the tubes are arranged more or less vertically in the upper layers of the silt. In life the individual usually lies head down with tail directed upward; the long caudal appendage projects above the substratum, moving back and forth, presumably for aeration.

C. ambiseta is associated with several other small annelids, notably *Streblospio benedicti* Webster, *Spiophanes missionensis* Hartman, and a tiny undescribed sabellid. From each of these, *C. ambiseta* can be distinguished in the field by its tube, its characteristic capitellid movements, and its color.

The generic name refers to the minuteness in size as compared with other known capitellids and the specific name to the dual appearance of pointed setae in both thorax and abdomen.

Holotype.—AHF no. 119; paratypes in the Allan Hancock Foundation.

Type locality.—Newport Bay, California; in sandy mud banks exposed at low tide line.

Distribution.—Southern California; intertidal.

Genus **NOTOMASTUS** Sars

KEY TO SUBGENERA

1. Nephridial apertures reduced to a few on the thorax, or absent; hood of abdominal hooks not voluminous, beak usually with 5 subequal teeth (pl. 47, fig. 2) *Clistomastus*
1. Nephridial apertures on the abdomen only or also on the thorax; hood of abdominal hooks greatly enlarged (pl. 50, fig. 3), beak variously formed *Notomastus*

Subgenus **NOTOMASTUS** EisigType *N. latericeus* Sars

The thorax consists of 12 segments; the second to twelfth are provided with only pointed setae in notopodia and neuropodia. The abdomen is provided with only hooded hooks. Branchiae are absent or present as eversible filaments or as noneversible vesicular pouches located on or near some abdominal ridges. Nephridia are present on some or all abdominal segments or also on some thoracic segments. Abdominal hooks are unusual in the only 2 species available for study in that the hood is greatly enlarged (pl. 50, fig. 3 and pl. 51, fig. 2); in one of them the beak is also unique (pl. 50, fig. 3).

Eight species have been described or recorded from the Western Hemisphere, but 2 (*N. luridus* Verrill and *N. tenuis* Moore) are here referred to *Clistomastus* (see below) and another (*N. gracilis* Verrill) is discussed under the genus *Heteromastus*. Some of the remaining 5 species are incompletely known. They are:

1. *N. agassizi* McIntosh (1885, p. 389) off New York in 1,340 fms. This remains incompletely known. See also Eisig, 1887, p. 868.
2. *N. brasiliensis* Grube (1868, p. 27) from Rio de Janeiro, Brazil. This is incompletely known. See also Eisig, 1887, p. 867.
3. *N. giganteus* Moore, p. 227.
4. *N. latericeus* Sars. This has been reported from the northeast coast of North America. See Eisig, 1887, pp. 861-863.
5. *N. parvus* Berkeley (1929, p. 312) from British Columbia.

Extra-American species are *N. eisigi* Benham (1916, p. 148) from south Australia; also *N. exsertilis* St. Joseph, *N. formianus* Eisig, and *N. profundus* Eisig from western Europe (see Fauvel, 1927, p. 147),

N. sinuosus Grube (1877) from China, *N. zeylanica* Willey (1905, p. 287) from the Gulf of Manaar, and *N. annenkowae* Zachs (1933, p. 130) from the North Japan Sea.

KEY TO SPECIES

1. Abdominal hooks supposedly lack a hyaline hood. . . *N. giganteus*
1. Abdominal hooks have a hood 2
2. Branchiae retractile, forming full bifurcated tufts that emerge from the posterior face of notopodia (pl. 50, fig. 6) present in median and posterior abdominal segments . . . *N. magnus*
2. Branchiae not retractile, consist of long filamentous structures (pl. 51, fig. 4) that arise from median and posterior abdominal neuropodia *N. lobatus*

Notomastus magnus, new species

Plate 50, Figs. 1-6

Dasybranchus giganteus Moore, 1909, p. 279, *not* Moore, 1906, p. 227 (see below).

Notomastus giganteus Berkeley, 1941, pp. 48-49.

Collections.—905-38 (posterior end); 1032-40 (6), 1130-40 (1); 1133-40 (fragment); 1142-40 (2); 1211-40 (many); 1252-41 (1); 1254-41 (1); 1265-41 (1); 1293-41 (1); 1294-41 (fragment); 1387-41 (1); 1441-41 (1); 1442-41 (3); 1457-42 (1); many others come from northern, central, and southern California, from shore stations especially in mud flat areas.

Mature individuals are large and robust; the total length approaches 30 cm (preserved) for larger specimens. In the thorax the body is about 7 mm wide. The thoracic epithelium is areolated throughout but decreasingly so in its posterior part (pl. 50, fig. 1). Lateral organs are present on all thoracic and abdominal segments; they are conspicuous in both regions, but in the thorax they may be more or less withdrawn since they are somewhat retractile as typical for these parts. They are located at the sides of the body, between notopodial and neuropodial ridges and slightly nearer the former.

The prostomium is a short, flattened lobe with subglobular palpode at its anterior end; it lacks eyespots but the nuchal slits are clearly visible near the posterior margin. The proboscis is coarsely papillated on its

proximal part, smooth and epithelial distally, but the two regions are not sharply separated from each other.

The thorax consists of 12 segments; each is biannulate and the 2 rings are nearly equal. The first one (peristomium) is apodous and achaetous. The second to twelfth segments have notopodial and neuropodial fascicles each provided with slender, pointed setae. The first fascicles are slightly smaller than those farther back but similar in other respects. Abdominal parapodia are provided with hooded hooks only. They are arranged in single series, in ridges that are shorter in notopodia, longer in neuropodia. Notopodial tori in anterior, median and posterior abdominal segments do not differ from one another except that there is a gradual decrease in length posteriorly with diminishing width of body.

Branchiae are conspicuous, tufted, retractile lobes, in median and posterior abdominal segments; they are already present from about the twenty-sixth abdominal segment, or on the second segment after the disappearance of the genital pores. The first few pairs are small and consist of a few eversible lobes; they are located immediately behind the outer posterior side of the notopodium (pl. 50, fig. 6). Where best developed, they gradually come to consist of a double tuft of about 40 or more vesicular filaments; they gradually diminish in size and number of branches in posterior segments.

Nephridial pores have not been found on the thorax. They are first present from the first abdominal segment and are probably continued posteriorly to the end. The external aperture is in a transverse groove, immediately behind the lateral organ, between notopodial and neuropodial ridges. In mature individuals, the first 20 to 24 pairs are modified as genital pores. These are conspicuous in female individuals, present from the first to about the twenty-fourth abdominal segment but they are abruptly absent thereafter.

Abdominal hooded hooks are long handled with shaft slightly twisted. The shoulder and neck are slender and continuous. The beak is sharply curved to form a large rounded crescent and a fang that is proportionately smaller than usual; it is flattened and terminates in a small boss. The crest is a closely fitting cap, smooth on its side except for a short transverse row of 4 small teeth above; on its inner concave side it is neatly sculptured with longitudinal crenulate ridges that number about 15 to 20; they terminate in short denticles. These crenulations probably correspond to the teeth of other species. The secondary short row has 4 teeth that alternate with 5 of the crenulations in the major row. The

condition of both fang and teeth is unique to this species. The hood likewise departs widely from that in other species in that it is high, voluminous, and has a large aperture that perhaps leaves much of the beak exposed even when the hooks are retracted in the parapodium; its distal free edge is finely serrated. The cleft is short. The shaft is finely and closely fibrillated into the beaked end. The great distance between the node and base of the hood is noticeable in this species. Its large hood is to be compared only with that in *N. lobatus* (see below).

The posterior end of the body tapers and terminates in a simple, collarlike ring without caudal appendages. Color in life is deep reddish brown; branchiae are dark red.

Notomastus magnus is characterized in having an areolated thorax with conspicuous lateral organs on all segments. Abdominal neuropodial tori are long and the 2 of a pair approach each other midventrally. Nephridial apertures are present only in the abdomen. Genital apertures in mature individuals are large and well developed on the first 20 to 24 abdominal segments. Retractable branchiae are bushy tufts; they arise from the posteroectal margin of the notopodial tori; they are present from about the twenty-sixth abdominal segment and continued posteriorly perhaps to the end. Hooded hooks are unique in that the lower main tooth is comparatively small and flat and partly surmounted by a double caplike structure, with a short transverse row of teeth on its outer side and sculptured with 18 to 22 crenulate ridges on its inner surface. It differs from other species of *Notomastus* particularly in the character of the branchiae and the distal ends of the hooded hooks.

These numerous individuals are believed to be conspecific with a collection of 6 individuals that originated from intertidal zones in San Diego Bay, California, reported as *Dasybranchus giganteus* (Moore, 1909, p. 279). Although actual comparison of individuals has not been possible, they are believed to be different from the Alaskan, deep-water species, *Notomastus giganteus* Moore (1906, p. 227). The former were described as follows: the protruded proboscis is subglobular, with 8 sulcated, radiating lobes and a closely granulated basal ring; thoracic segments are areolated on the surface; abdominal segments have neuropodial tori with extensive low ridges that become more elevated dorsally and end abruptly in a prominence; above them is the small but distinctly rounded, ovoid lateral organ. The very small notopodial tori are dorsal and connected across the dorsum by a low transverse fold; posteriorly they become very obscure. Branchiae are conspicuous bushy tufts of 20 to 30

filaments; they arise from the posterior end of the notopodial torus. However, abdominal lateral organs were described as distinct only posteriorly where the tori become widely separated; thoracic lateral organs and genital pores were not observed. Except for these differences there is remarkable agreement. Since the ecological and geographical distributions are the same, I suggest that these individuals are actually conspecific with those described as *N. magnus* but that they are probably not the same as *N. giganteus* Moore from deep water off Alaska. *N. giganteus* Berkeley (1941, p. 48) from Anaheim Slough, California, may also belong here.

Notomastus giganteus Fauvel (1932, p. 194) from off Ceylon and Orissa is perhaps some other species, since only the first 9 (instead of 20 to 24) pairs of genital pores are conspicuous and the abdominal notopodia are obsolete to vestigial; also the branchiae consist of a transverse row of small filiform papillae instead of a dual branched structure as in *N. magnus* (pl. 51, fig. 6).

Holotype.—AHF no. 120; paratypes in the Allan Hancock Foundation.

Type locality.—Tomales Bay, California; intertidal.

Distribution.—This species occupies an extensive geographic area, in intertidal or littoral zones, from northern California south at least to San Diego, California. It occurs in sandy mud flats that have daily exchange of tidal currents and especially in zones that are covered over by narrow-leaved eelgrass (*Phyllospadix*).

***Notomastus lobatus*, new species**

Plate 51, Figs. 1-5

Collections.—1107-40 (1); 1069-40 (about 60 anterior ends).

The longest and largest individual (station 1107-40) consists of thorax and 47 abdominal segments (posteriorly incomplete) and measures about 60 mm long and 5.5 mm wide in the thorax. Segments are strongly biannulate in the thorax and the epithelium is finely areolated in a longitudinal direction. The biannulation of abdominal segments is somewhat obscured by 3 to 5 additional shallow grooves between successive parapodial ridges.

The proboscis (not everted in any individual) is papillated on its proximal part and perhaps over much of its surface (observed by dissection). The prostomium is a plain, triangular, slightly depressed lobe, without eyespots but with a pair of nuchal slits at its posterior margin.

The first segment is achaetous and apodous. Segments 2 to 12 are provided with notopodial and neuropodial fascicles, the first pair already well developed. Lateral organs are small but present from the first setigerous segment; they are located between notopodia and neuropodia and slightly nearer the former.

In the abdomen the ventrum is flat, solelike and the dorsum is increasingly arched upward in posterior segments. Neuropodial tori are long in a tranverse direction; they extend ventrally so that the 2 of a segment approach each other midventrally (pl. 51, fig. 4). The superior portion of the ridge is highly vesicular and branchial, already from the first; by the thirteenth or fourteenth abdominal segment it comes to be a long simple lobe which continues so through at least 18 segments (a posterior portion is lacking). These branchiae are not retractile; they are merely prolongations of the superior part of the neuropodial torus.

Lateral organs in the abdomen are low, ovoid papillae located just above the inflated neuropodial lobe; they are visible in this position through the known length (about 47 abdominal segments). Notopodial tori are seemingly absent from the abdomen. Instead, the epithelium is thin, inflated and the longitudinal muscles are visible through the body wall around the dorsal and lateral portions of the body.

Nephridial apertures are present in the thorax and abdomen. In the former they are to be found in the segmental grooves, between the seventh and eighth setigerous segments, about half way between notopodia and neuropodia and are continued posteriorly to between the eleventh and twelfth segments. In the abdomen they are on the first 3 segments, immediately in front of the lateral organ.

Hooded hooks are long handled; the shaft is coarsely and distinctly fibrillated. The distal end terminates in a bifid beak with a voluminous hood that fits loosely about the beak. The fang is strong, large and directed slightly downward. It is surmounted by 3 or 4 teeth in a single row; the fourth tooth may be lacking and if present is usually a smaller one at the end of the series. The large hood is more nearly like that in *N. magnus* (see above) than in any other species examined.

N. lobatus is characterized by its peculiar simple, lobed, nonretractile branchiae that are prolongations of the superior neuropodial ridge; they are present from about the fourteenth abdominal segment and continued posteriorly. Notopodial abdominal tori are believed to be absent. Hooded hooks have a large, loosely fitting hood; the crest consists of a transverse row of 3 or 4 small teeth. Lateral organs are visible on all known seg-

ments. Nephridial pores are present on posterior thoracic and abdominal segments located in the segmental grooves.

Holotype.—AHF no. 121; paratypes in the Allan Hancock Foundation.

Type locality.—Sta. 1107-40, Espiritu Santo Island, Gulf of California in 29-35 fms.

Distribution.—*N. lobatus* is known only from the upper end of the Gulf of California at Consag Rock and south to Espiritu Santo Island, in 21 to 35 fms on a muddy bottom.

Notomastus giganteus Moore

Moore, 1906, pp. 227-228, pl. 11, figs. 24, 25. *Not Dasybranchus giganteus* Moore, 1909 (see above, under *Notomastus magnus*)

It has not been possible to examine any authentically labelled specimens of this species nor any from near the type locality. The holotype is deposited in the U.S. National Museum. The species was originally described from Chatham Strait, Alaska in 282-293 fms (Moore, 1906, pp. 227-228) based on a single individual that was not very well preserved; additional individuals attributed to the same species originated in the Gulf of Georgia in only 31 to 90 fms. The following characters are those of the holotype as first recorded.

Total length is about 6 inches. The protruded proboscis (collapsed) is discoid and wrinkled, hence presumably not papillated at the base. The prostomium is a small, rounded lobe with a minute conical palpode. No mention is made of eyes or nuchal slits. The thoracic segments are strongly biannulate, the anterior ring the shorter. Each ring is marked out in irregular areas [areolated] one series to each ring, but setigerous segments 3 to 6 are irregularly arranged in 2 series. From the seventh setigerous segment the rings are smooth, more glandular than those anterior, and they decrease in length but the last one is about one and one-half times as long as the first abdominal segment. No lateral sense organs or genital pores could be detected in surface view. [Hence this is at once different from *N. magnus*, see above, in which both lateral organs and nephridial apertures are conspicuous, pl. 50 fig. 1.]

Abdominal segments are very short and have shallow, ill-defined furrows. They are either simple rings or in the anterior region they are obscurely biannulate. The surface is smooth, the integument provided with a thick, glandular coat anteriorly. The neuropodial [originally called notopodial] tori are very long, not elevated above the surface.

Notopodial tori are much more elevated and prominent, especially in posterior segments, but they are much shorter than the neuropodial ones and contain a much smaller number of uncini.

Branchiae were described as low, rather long, inconspicuous folds. Abdominal hooks are shown with a strong fang, nearly at a right angle to the main stem and surmounted by a semicircle of 8 or 9 small teeth above, designated a depressed hood (crest as herein used). A hyaline sheath or hood is presumably absent.

In several important respects this individual is thus strikingly different from *N. magnus* (see above). The pattern of the proboscis, thoracic epithelium and abdominal parapodia are notably different. Hooded hooks of the abdomen are distally provided with a main fang overarched by only 8 or 9 denticles. Even if the branchiae were completely retracted in this individual, which is not unlikely, and were thus not described, there are still other significant differences between *N. giganteus* and *N. magnus*, especially in the lateral organs and nephridia, the segmental grooves of the abdomen, the proboscis and the abdominal hooks (see above).

A more complete knowledge of the species, *N. giganteus*, depends therefore either on reexamination of the holotype specimen or a redescription based on collections from the type locality.

Subgenus **CLISTOMASTUS** Eisig

Type *Notomastus* (*C.*) *lineatus* Claparède

This agrees with *Notomastus* (*sensu stricto*) in many respects except that nephridial apertures are limited to a few posterior thoracic segments, or are reduced or even absent. Abdominal hooks are hooded; the fang is straight and slender or somewhat recurved and surmounted by a crest of 5 (rarely 6) teeth in a single or alternating transverse row. The shaft is fibrillated throughout its length except for a soft, slightly granular base.

Only one species, *N. (C.) lineatus* (see below) has heretofore been referred to this genus. Two others, *N. tenuis* Moore and *N. luridus* Verrill are newly ascribed to it and a fourth, *N. hemipodus*, is newly described. A fifth species, known as *Eisigella ouanaryensis* Gravier (1902, p. 266) may also belong here. The genus *Eisigella* Gravier is known through this single species and is said to differ from *Notomastus* only in that nephridial pores are either absent or rudimentary. This

character may have only specific significance or even be at least partly dependent on the age of the individual.

KEY TO SPECIES

1. Abdominal neuropodia enlarged, branchial; the first setigerous segment complete with notopodia and neuropodia. *N. (C.) lineatus*
1. Abdominal neuropodia not so enlarged; first setigerous segment with notopodia but not neuropodia 2
2. Prostomium with eyes 3
2. Prostomium without eyes (pl. 49, fig. 2) *N. (C.) luridus*
3. Prostomial eyes consist of oval patches of 15 to 20 each (pl. 47, fig. 4) posterior notopodia somewhat prolonged (pl. 47, fig. 5) *N. (C.) tenuis*
3. Prostomial eyes consist of a single pair of small spots (pl. 48, fig. 3); posterior notopodia not so prolonged (pl. 48, fig. 2) *N. (C.) hemipodus*

Notomastus (Clistomastus) lineatus (Claparède)

Plate 46, Figs. 1, 2

Notomastus lineatus Fauvel, 1927, pp. 145-146, fig. 51; Berkeley, 1932, pp. 674-675.

Collection.—1457-42 (2 anterior ends).

Two small, short anterior fragments are referred to this species. They consist of the thorax and 5 abdominal segments and measure only 14 mm long. The thorax is much inflated at the fourth to sixth setigerous segments. Its surface is strongly areolated through the first 6 segments. Notopodial and neuropodial setal fascicles are well developed through the second to twelfth thoracic segments. Nephridial pores are visible between the eighth/ninth, ninth/tenth, and tenth/eleventh thoracic setigerous segments; they number only 3 pairs.

In the abdomen the thoracic uncinigerous tori are short and approach each other mid-dorsally. The superior edge of the neuropodium is inflated and branchial. Neuropodial tori are long and largely ventral in position; the two of a segment approach each other midventrally. Lateral organs are visible on all segments; they are in the usual position between notopodia and neuropodia. The prostomium is conical and has a short palpode. There are 2 elongate patches or pigmented eyespots at the dorsolateral posterior margin and in front of the nuchal slits.

Hooded hooks are angled proximally, the shaft turned abruptly back near the base. On the back of the hook the node is sharp. The hood is short but spacious. The beak is long, slender and surmounted by 5 well separated teeth in a slightly crescentic row (pl. 46, fig. 1). The fibrillations of the core are widely spaced and extend to the base of the hook.

Distribution.—*Notomastus (Clistomastus) lineatus* has been previously recorded from British Columbia (Berkeley, 1932, p. 675). The present record is from Newport Bay, southern California, from muddy flats at low tide line. These are the only known records from the Western Hemisphere.

***Notomastus (Clistomastus) tenuis* Moore**

Plate 47, Figs. 1-5

Notomastus tenuis Moore, 1909, pp. 277-278, pl. 9, fig. 55.

Notomastus angulatus Chamberlain, 1919b, pp. 16-17; Berkeley, 1929, p. 312; MacGinitie, 1935, p. 694.

Eisigella tenuis Berkeley, 1942, p. 198.

Collections.—903-38 (7); 905-38 (5); 1211-40 (2); 1368-41 (1); 1441-41 (many); 1443-41 (3); 1445-42 (1); 1447-42 (many); 1450-42 (6); 1451-42 (2); 1457-42 (several); 1472-42 (1); 1492-42 (5); many others from central and southern California from intertidal areas.

The body is long, slender and appears nodular in its posterior extremity because of the elevated notopodia (pl. 47, fig. 5). The thorax is weakly areolated through its anterior half but smooth thereafter. A shallow longitudinal groove extends along the sides of the thorax (pl. 47, fig. 1). The prostomium is depressed conical; it has a pair of elongate, pigmented ocular areas at the posterior margin in front of the nuchal slits; each area consists of 15 to 20 spots. The proboscis is coarsely papillated proximally but smooth and epithelial distally. The first visible segment is apodous and achaetous; it is about one and one-third times as long as the next segment (pl. 47, fig. 1).

The first setigerous segment has notopodia but neuropodia are absent. The next 10 segments have notosetal and neurosetal fascicles of slender, pointed setae. The peristomial ring and the next 7 segments are weakly areolated (pl. 47, fig. 1).

Lateral organs are small; each is visible as a tiny papilla between the parts of a parapodium but nearer the notopodium; they are present throughout thoracic and abdominal segments. There are no branchiae

or other special parapodial structures that function as such but in a far posterior region both rami of the parapodia come to be somewhat elevated to form vesicular lobes (pl. 47, fig. 3).

Abdominal parapodia are well separated from one another. In median segments the ridges are only slightly elevated but farther back the notopodia are progressively longer and directed posteriorly. Uncini in a series are few, those in the notopodia less numerous. Median segments have only 4 or 5 in the dorsal ramus and 6 to 10 in the ventral one. Farther back the notopodium may have only 1 or 2 inconspicuous hooks that are easily overlooked and the neuropodium may have 4 or 5.

Hooded hooks are characteristic. The distal end is hooked and covered with a hood that extends only slightly beyond the beaked end; it has a restricted oval aperture. The hook has a thickened shoulder and slender neck and terminates in a long fang surmounted by a crescentic row of 4 or 5 short teeth. In lateral view the crescentic row gives the impression of only 2 small teeth.

Nephridial apertures are present on the thorax, in the segmental grooves at the sides of the body; the first are between the seventh and eighth, the last between the tenth and eleventh, setigerous segments; they number 4 pairs (pl. 47, fig. 1).

This species is herein newly referred to the subgenus *Clistomastus* because nephridial pores, though small, are present on some thoracic segments. There are no specialized branchiae but in median and posterior abdominal segments the parapodial ridges may be branchial in function. Abdominal hooded hooks have a transverse row of 4 or 5 teeth above the fang.

Notomastus angulatus Chamberlain is now believed to be conspecific with *N. (C.) tenuis* since the slight differences that have been used to separate them (relative thickness of thorax and abdomen and rugosity of posterior segments) are characters that are believed to intergrade among individuals of a species. *N. tenuis* Moore (1909, p. 277) was originally described from San Diego, California; it was based on a single macerated individual. *N. angulatus* Chamberlin (1919b, p. 16) was also described from southern California at Laguna Beach. It was separated from the first for having a more angulate thoracic cross section but no distinct morphological differences have been found between them.

I agree with Berkeley (1942, p. 198) that branchiae and genital pores are absent; however, nephridial pores have been found in posterior thoracic segments in individuals from California and Oregon; the species is

therefore referred to *Clistomastus* instead. Furthermore, as suggested in the generic diagnosis above, *Eisigella* may prove to be congeneric with *Clistomastus*.

Distribution.—*Notomastus* (*Clistomastus*) *tenuis* is common in intertidal zones of California from San Diego north to northern California and Oregon. As *Eisigella tenuis* (Moore) it has been reported from British Columbia in intertidal zones (Berkeley, 1929, p. 312).

Notomastus (*Clistomastus*) *luridus* Verrill

Plate 49, Figs. 1-5

Notomastus luridus Verrill, 1873, p. 610; Hartman, 1942, pp. 68-69.

Material examined.—Barnstable, Massachusetts, August 30, 1875 (4 specimens from Verrill's collection at Yale University).

Total length exceeds 80 mm (preserved) but none of the individuals is entire. The prostomium is depressed, approximately triangular, about as long as wide or slightly longer; it has a slenderer anterior prolongation corresponding to a palpode; there are no visible eyespots; the nuchal slits occupy the usual position at the posterior margin. The proboscis, everted more or less completely in 3 individuals, is sacklike, coarsely papillated on its proximal portion but smooth and glistening distally; separation between the 2 regions is abrupt. When the proboscis is completely everted the papillar region is hardly visible.

The entire thoracic region is areolated but most conspicuously in the first 6 segments and decreasingly thereafter. The abdominal region is smooth except for transverse and oblique folds and wrinkles. Separation between thorax and abdomen is more or less distinct because of the change in parapodial parts from setae to hooks and because the body tends to be abruptly wider in the abdomen than in the last thoracic segment. Most of the thoracic length is marked by a broad, shallow ventral groove and lesser furrows at the sides between the notopodial and neuropodial parts.

The first segment or peristomium is apodous and achaetous; it is entire or weakly biannulate on its ventral side; its length is about that of the next segment. The second, or first setigerous, segment is wider and provided with an inconspicuous notopodial fascicle and a small lateral organ on either side; these parts may be more or less withdrawn so as to be hardly visible. The second setigerous segment is similar but the notopodium is slightly larger and a minute neuropodial fascicle can be distinguished. By the third setigerous segment the setal fascicles are still

small but by the fourth they are much larger and have the characteristic fan-shaped fascicles as those farther back. Lateral organs increase in size to the middle of the thoracic region but they tend to be somewhat concealed by the shallow lateral groove and by a superior raised portion of the neuropodia; they are located between the parts of the parapodia but nearer the dorsal branch. Nephridial pores have not been distinguished in any part of the thorax or abdomen but whether they are present during a stage in the ontogeny of this species cannot be determined from the single collection available. The last 3 or 4 segments of the thorax are longer and slenderer than those farther in front; the length is nearly twice the width at its greatest development; the setal fascicles are at the anterior end of the posterior half but the last thoracic segment is again shorter and its parapodia are located near the posterior end of the segment.

Abdominal segments are noticeably shorter and wider than the posteriormost thoracic segment. A sharp, narrow groove extends lengthwise along the middorsum. Parapodial ridges are located on the posterior third and move gradually farther back toward the segmental groove. By the eighth or ninth segment there is an anterior, inflated portion and a constricted posterior third on which are located the uncinigerous tori. When individuals are strongly contracted through preservation, the inflated region may have the appearance of being strongly wrinkled in a transverse direction.

Notopodial ridges are shorter than the neuropodial ones and dorsal in position but the 2 of a pair are separated by a narrow space and by the narrow longitudinal furrow. Neuropodial ridges are ventrolateral in position and the 2 of a pair are separated by a broad space that extends nearly across the width of the body. Neuropodial uncini are in longer rows, bounded by a raised membrane that is prolonged dorsally so as to extend nearly to the notopodium but the 2 are separated by a depression in which the papillar lateral organ is located (pl. 49, fig. 1). This arrangement continues posteriorly through at least 60 abdominal segments. No branchiae or nephridial pores have been distinguished.

The hooded hooks of the abdomen have a shaft with distinct but short shoulder and neck regions. The hood is short and extends distally only slightly beyond the crest. The margin of the aperture appears smooth but may be vaguely dentate. The beak terminates in a long fang surmounted by a crest with 5 teeth arranged in 2 rows in which 3 teeth below alternate with 2 above (pl. 49, fig. 5). The base of the shaft is only slightly curved backward.

According to Verrill (1873) color in life is dark purplish brown with a bluish iridescence anteriorly and a darker median dorsal line posteriorly; the surface is strewn with minute white spots.

This species is herewith referred to the subgenus *Clistomastus* because nephridia are seemingly either vestigial or absent; abdominal hooded hooks are similar to those in the other species of *Clistomastus* that have been examined but in this species the hooks are unique in that the 5 teeth in the crest are not in a straight row but 2 have been displaced upward to form a second, alternating row.

I am indebted to Dr. Stanley Ball of the Peabody Museum of Natural History at Yale University for the loan of materials on which this redescription is based.

Distribution.—*Notomastus (Clistomastus) luridus* is known from localities in New England south to New Jersey, from intertidal zones.

Notomastus (Clistomastus) hemipodus, new species

Plate 48, Figs. 1-5

Collections.—Numerous individuals come from the vicinity of Beaufort, North Carolina; some were dredged from shallow waters in Bogue Sound, others come from muddy sand shoals exposed at low water near the mouth of the Newport River and from Bird Shoal.

In size this species is intermediate between the other capitellids with which it occurs, including the smaller *Heteromastus filiformis* (Claparède) and the larger *Dasybranchus lumbricoides* Grube. Length of 52 segments (posteriorly somewhat incomplete) is about 30 mm; the maximum width in the thorax is 1.5 to 1.7 mm. The epithelium of the thorax is somewhat areolated through only the first 5 segments; the last 7 segments are increasingly smoother. The body is slightly arched upward in its anterior portion as in other capitellids. The abdomen is nearly smooth except for the glandular ridges and transverse wrinkles of contraction.

The prostomium is an elongate, triangular, somewhat depressed lobe; its anterior end is prolonged in a slender palpole. Its dorsal surface near the posterior margin has 2 minute, dark red eyespots and a pair of nuchal slits that are to be seen only by pushing back the peristomial fold. The proboscis, everted in some individuals, is closely papillated on its proximal half but the distal part is smooth and covered with a thin membrane.

The thorax consists of 12 segments; each is more or less clearly biannulate. The first or peristomial segment is achaetous and apodous. The second one has a dorsal fascicle of capillary setae but no visible neuropodium (hence the specific name). From the third segment, notopodia and neuropodia are present; the 2 branches are widely separated from each other. This arrangement continues through the last 10 thoracic segments. Lateral organs, as typical for the genus are present on all thoracic and abdominal setigerous segments; they are located nearly midway between notopodia and neuropodia but slightly nearer the former. Those in abdominal segments are noticeably the larger. There are 4 pairs of nephridial pores at the sides of the body, along a lateral depression and in the grooves that separate segments 8/9, 9/10, 10/11 and 11/12 but they are inconspicuous and can be seen only by pushing the segments apart. None have been found on the abdomen; this species is therefore referred to the subgenus *Clistomastus*.

The first abdominal segment is slightly thicker than, and about as thick as, the last thoracic one. It has transverse wrinkles of contraction. Both notopodial and neuropodial tori are provided with only simple hooded hooks, disposed in single rows. Abdominal notopodia of a pair approach each other at the middorsum so that their glandular ridges are adjacent. Neuropodia, however, are lateral to ventrolateral in position and have longer glandular ridges and tori. In anterior abdominal segments the superior edge of neuropodia is slightly elevated to form a small papilla; this is less conspicuous farther back.

Hooded hooks have a long, straight shaft except for the thick node near the middle. The fang is strong and sharply curved downward; it is surmounted distally by a row of 5 or 6 fine teeth. The hood neatly surrounds the beak; its aperture is small and oval.

No distinct branchial structures or genital pores have been identified; they are believed to be absent. Respiration is perhaps accomplished only through the surface epithelium. Gonadal products may be released from the body only by autotomy or rupture of certain segments.

Notomastus (Clistomastus) hemipodus is characterized in having the thorax areolated through only the first 5 segments; the first setigerous segment lacks neuropodia. Lateral organs are present throughout. Nephridial apertures number only 4 pairs and are present in posterior thoracic segments. Prestomial eyes consist of a single pair of spots in front of the nuchal slits. Hooded hooks terminate in a strong, recurved fang surmounted by 5 or 6 teeth in a single transverse row; the hood is

closely sheathing and has a small aperture. It differs from other species of the subgenus as indicated in the key above.

Holotype.—AHF no. 78; paratypes in the Allan Hancock Foundation.

Type locality.—Beaufort, North Carolina.

Distribution.—Beaufort, North Carolina, from intertidal zones to a few fathoms, on muddy bottoms.

Genus **HETEROMASTUS** Eisig

Type **H. filiformis** (Claparède)

The thorax consists of 12 segments of which 11 are setigerous; the second to sixth segments are provided with only pointed setae, the seventh to twelfth segments have only long-handled, hooded hooks. The abdomen is provided with only hooded hooks in notopodia and neuropodia. Branchiae are either filamentous prolongations or vesicular modifications of parapodial parts. Genital apertures are limited to the thorax; lateral organs are present on the thorax and anterior abdominal segments.

The long handled hooks of this genus are of considerable interest because those of the thorax and abdomen, though at first seemingly different from each other, are essentially alike in their principal parts. Each consists of a long shaft with node, shoulder, neck and beak surrounded by a hyaline hood, but in thoracic hooks these parts are almost imperceptible except by actual measurement. It seems possible that these thoracic hooks represent primitive forerunners of the more compact, modified hooks farther back.

Three species of *Heteromastus* have been described or reported from the Western Hemisphere; they include *H. filiformis* (Claparède), *H. filobranhus* Berkeley and *H. similis* Southern. A fourth species described as *Notomastus gracilis* Verrill (1880, p. 180) may also belong to the genus since it has both hooks and setae in the thorax; however, 6 (instead of 5) anterior segments were said to have pointed setae. I have seen no individuals from England or vicinity that fulfill this description (see also Hartman, 1942, p. 11). The first 2 species are present in the collections (see below). The third, originally described from a brackish lake in India (Southern, 1921, pp. 640-642) has been reported from fresh water in Uruguay (Monro, 1937, p. 249). In addition, *H. giganteus* Zachs (1933, p. 131) comes from the North Japan Sea.

KEY TO SPECIES

- | | |
|---|----------------------------|
| 1. Without filamentous branchiae | 2 |
| 1. With palmately arranged, filamentous branchiae after the thirtieth abdominal segment | <i>H. filobranchus</i> |
| 2. Inhabiting freshwater | <i>H. similis</i> Southern |
| 2. In marine habitats | <i>H. filiformis</i> |

Heteromastus filiformis (Claparède)

Plate 52, Figs. 1-4

Notomastus filiformis Verrill, 1873, p. 611.*Areniella filiformis* Verrill, 1874, pp. 386-387.*Ancistria capillaris* Verrill, 1874, pp. 385-386.*Ancistria minima* Webster, 1879, p. 258.*Notomastus laevis* Webster, 1886, p. 152.

Eisig, 1887, pp. 839-846, pl. 1, fig. 4, pl. 27, figs. 15-21, pl. 28 figs. 1-17, pl. 32, figs. 15-18; Fauvel, 1927, pp. 150-152, fig. 53; Hartman, 1942, p. 70.

Collections.—Numerous individuals come from central California, Florida, North Carolina and Massachusetts; all are from intertidal zones.

In its grosser details this species is well known through numerous accounts. The details of the hooded hooks in the thorax and abdomen are shown in plate 52, figs. 1-4. Thoracic hooks measure about 0.3 mm long and 0.005 mm wide; the width/length ratio is thus approximately 1/60. Similar proportions of abdominal hooks are about 1/15. The thoracic hooks are thus proportionately far longer than are the abdominal hooks, but in the details of their structure they are similar. Both have the characteristic parts consisting of shaft with node, shoulder, neck, beak with crest and fang and overhanging hood. In the thoracic hooks the node, shoulder, neck and hood are diffused over a far greater length than in abdominal hooks; it is only by microscopic measurement that neck, shoulder and node can be detected. By careful measurement of thickness along the shaft from tip to base one encounters a slender portion below the beak (=neck) followed by a thicker region (=shoulder) continuing into a region which is again slender and then a thicker region (=node) embedded in the tissue of the parapodium; the basal end terminates in a gradually tapering, slender end.

The distal end of the thoracic hooks terminates in a thick fang with a crest of 6 well separated teeth in a single, slightly curved row. The hood is long and slender but fits well over the beak; it has a small aperture and long slit (pl. 52, fig. 3). The distal end of abdominal hooks terminates in a long, thick fang and 3 teeth, the middle one slightly higher than the others. It may be supposed that the 6 terminal teeth in thoracic hooks represents a more primitive condition in which they subsequently fused by twos; this fusion might result in a tridentate hook. The same pattern is to be observed in *H. filobranthus* (see below) and may represent a character of generic significance.

The extensive synonymy of this species is recorded elsewhere (Eisig, 1887, p. 839).

Distribution.—*H. filiformis* is widely distributed in Western and Eastern Hemispheres; it is common along the eastern shores of North America from New England south at least to Florida; it occurs especially in mud flat areas. It has been found also in San Francisco Bay, California where 4 individuals were collected in July, 1936; in so far as I know this constitutes the first record from the western shores of the Americas.

***Heteromastus filobranthus* Berkeley**

Plate 53, Figs. 1-4

Berkeley, 1932, pp. 671-674, figs. 5-7.

Collections.—Monterey Bay, California in 37 fms (many); San Francisco Bay, California in 5¼ fms (8).

Lateral organs are present on the sides of the thorax between the notopodium and neuropodium but nearer the former. Nephridial apertures are visible in intersegmental grooves, the first between setigerous segments 6 and 7, the last between 10 and 11; they number 5 pairs. There are no visible lateral organs or nephridial pores on the abdomen. The characteristic palmately divided filamentous branchiae in the abdomen clearly distinguish this species from the nearly related *H. filiformis* (see above).

Hooded hooks in the thorax and abdomen are distinct from those in *H. filiformis*. In the first the crest consists of only 3 teeth in a straight transverse row (pl. 53, fig. 4) instead of 6 teeth. In abdominal hooks the shoulder is thick and rounded, the neck is slender; the crest consists of a single, straight row of 3 teeth.

Distribution.—*H. filobranthus* has remained unreported except through the original description (Berkeley, 1932) based on a collection

from the east coast of Vancouver Island, British Columbia in 15-20 fms and from Rosario Inlet, Washington in 5-6 fms.

The present collections were made by the U.S.S. *Albatross*, station 3133, Monterey Bay, California in 37 fms, March 14, 1890 from a bottom of brown mud and from station D5744, San Francisco Bay, California in 5¼ fms, March 18, 1912.

Genus **LEIOCHRIDES** Augener

Type **L. australis** Augener

The thorax consists of 13 segments; the first or peristomium is achaetous, the second to twelfth segments are provided with notopodia and neuropodia in which all setae are slender and pointed. The abdomen is provided with only long-handled, hooded hooks. The prostomium has eyespots. The surface epithelium is not areolated. Branchiae have not been described and may be absent. The pygidium is terminal and lacks modified papillae or other special structures.

Leiochrides was erected for a single species, *L. australis* Augener (1914, p. 60) from Australia. A second species, *L. africanus* Augener (1918, pp. 472-474) from west Africa, was later referred to it. A third species, *Notomastus pallidior* Chamberlin (see below) is believed to be congeneric.

Leiochrides pallidior (Chamberlin), new combination

Notomastus pallidior Chamberlin, 1918, p. 179; Berkeley, 1942, p. 198.

There are no representatives available for study. The species is known through an original, unillustrated account that is incomplete in some important details. Since it was originally referred to the genus *Notomastus*, it is presumed that all thoracic segments have pointed setae only and that the abdominal parapodia have hooks only. None of the specimens described were complete posteriorly; the pygidial structures therefore remain unknown. Color in life is yellow.

The thorax consists of 12 setigerous segments; it is thus not a *Notomastus*. Only 3 genera of Capitellidae are known in which the thorax consists of an achaetous peristomium and 12 setigerous segments. They are *Heteromastides*, *Leiochrides* and *Scyphoproctus*. The first of these differs in that it has thoracic hooks as well as setae. The last has an anal funnel and acicular spines. The second, *Leiochrides*, is thus the only remaining genus to which *Notomastus pallidior* can be referred, in so far as the species is known.

L. pallidior was originally compared with *Notomastus tenuis* and *Notomastus angulatus* (see *Clistomastus tenuis*), hence is believed to lack special branchiae. The arrangement of parapodial parts, the structure of hooks, the distribution of lateral organs, nephridia or genital pores, are not known. Without more information about the species, comparison with others is not possible.

Distribution.—Originally described from Pacific Grove, California, this has been reported also from Vancouver Island, British Columbia, in 89 meters (Berkeley, 1942, p. 198).

Genus *Dasybranchus* Grube

Type *D. caducus* (Grube)

The thorax consists of 14 segments of which the second to fourteenth are setigerous and provided with only pointed setae in notopodia and neuropodia. The abdomen is provided with only hooded hooks. Branchiae are either retractile or stationary; they are simple lobes or progressively lobed to form composite tufts. They arise from the epithelium near the superior and posterior edge of abdominal neuropodia. Lateral organs are more or less conspicuous; they are sometimes difficult to distinguish in external view but are probably present in both thorax and abdomen. Genital apertures are present on some abdominal segments. Nephridial pores occur on the thorax and abdomen.

The abdominal hooded hooks of the various species of the genus show interesting similarities. The typical arrangement is for the large fang to be surmounted by a single row of 3 teeth. In *D. lumbricoides* the teeth are low, well separated from each other, in *D. glabrus* they are partly fused and in *D. lunulatus* they are more or less completely fused for their entire length. In *D. platyceps* there is an additional feature in that the basal fang is seemingly divided into a larger lower, and a much smaller, upper portion (pl. 55, fig. 3).

Eight species of *Dasybranchus* may be recognized but some are poorly and incompletely known. Five have been described or reported from the Western Hemisphere; they include *D. caducus* (Grube) from the West Indies (see Monro, 1933, p. 1059) and western Mexico (Rioja, 1941, p. 730), *D. glabrus*, *D. lumbricoides*, *D. lunulatus* and *D. rectus* Treadwell (1901, p. 207) from the West Indies (see below). The last named is incompletely known; even its generic status must be regarded doubtful for it has since been redesignated *Scyphoproctus* (Treadwell, 1939,

p. 290) but no description given of an anal funnel such as characterizes that genus (see chart).

Three other species of the genus have been described from extra-American localities; they include *D. carneus* Grube (1870) from the Red Sea, *D. gajolae* Eisig (1887) from the Gulf of Naples, and *D. microchaetus* (Schmarda) (1861) from Ceylon.

Another species, *D. platyceps* is newly described below.

KEY TO SPECIES

1. Retractable branchiae consist of dendritically branched tufts . . . 3
1. Retractable branchiae consist of only a few filaments each . . . 2
2. Prostomium with a pair of pigmented areas or eyespots . . .
 *D. lunulatus*
2. Prostomium without eyespots *D. glabrus*
3. Abdominal parapodial ridges low and glandular but not inflated;
 hooded hooks terminate in a primary and secondary fang sur-
 mounted by 3 small denticles (pl. 55, fig. 3) . . . *D. platyceps*
3. Abdominal neuropodial ridges elevated or inflated above the
 branchial pores; hooded hooks lack secondary fang (pl. 56,
 fig. 4) 4
4. Anterior abdominal notopodia widely separated from each other
 *D. caducus* (Grube)
4. Anterior abdominal notopodia proximal to each other, nearly
 merging middorsally *D. lumbricoides*

Dasybranchus lumbricoides Grube

Plate 56, Figs. 3, 4

D. caducus lumbricoides Monro, 1933, pp. 1059-1060; Berkeley, 1941, p. 49.

Collections.—903-38 (2); 905-38 (3); 1045-40 (2); 1450-42 (1); 1451-42 (1); numerous others come from intertidal areas of southern California, Lower California and other parts of western Mexico; also Lemon Bay, southwestern Florida and Beaufort, North Carolina.

Anterior abdominal notopodial tori of a pair are proximal to each other and after the first few segments nearly merge so that those of a pair appear to be continuous across the middorsum. This character distinguishes the species from *D. caducus* (Grube) with which it might be confused. Branchiae are retractile; where best developed, in median and posterior abdominal segments, they consist of 30 or more filaments each;

they emerge from the superior end of the neuropodial tori. In addition, in prebranchial segments the superior part of the neuropodial lobes is vesicular and inflated; it appears somewhat transversely ridged or wrinkled when preserved in alcohol. The thoracic epithelium is distinctly areolated.

Abdominal hooded hooks are uniformly similar throughout, as typical of other species of the family where they have been examined. The shaft has a gently sloping, dispersed node. The hood is spacious, with fine denticulated edge; this is somewhat overhanging and is so close to the crest that the serrated edge sometimes distorts the appearance of the teeth in the crest, leading to an erroneous impression that there are several rows of teeth in the crest. The fang is strong and slightly curved, crowned by a transverse row of 3 small, well separated teeth (pl. 56, fig. 4).

D. lumbricoides has sometimes been referred to the older *D. caducus* (Grube) (see Eisig, 1887, p. 823 and Fauvel, 1927, p. 148) or has been considered at most as a variety of the stem species (see synonymy above). I have no specimens of *D. caducus*, hence cannot make comparison, but according to published accounts the 2 species seem to be separable in that the anterior abdominal notopodia are widely separated from each other in *D. caducus* and are proximal to each other in *D. lumbricoides*. All of the specimens enumerated above are of the latter kind.

Distribution.—*D. lumbricoides* has been widely reported from cosmopolitan areas. It is represented in the collections by individuals from California, western Mexico, southwestern Florida and Beaufort, North Carolina, all from shore stations.

Dasybranchus lunulatus Ehlers

Plate 56, Figs. 1, 2

Ehlers, 1887, pp. 174-177, pl. 45, figs. 5-9.

Collections.—Lemon Bay, southwestern Florida, in muddy shoals; Thornton Island, near Englewood, Florida, in muddy sand (7).

The prostomium is largely concealed by the overhanging, collarlike peristomium; when the latter is pushed back the prostomium is seen as a thick, short lobe, broadly rounded anteriorly or with a slight median emargination. There are 2 conspicuous patches of reddish brown eyespots at the sides located in front of the nuchal slits. The first segment or peristomium is nearly $2\frac{1}{2}$ times as long as the following one.

The epithelium of the thorax is smooth except for fine wrinkles of contraction. The segments are only partly biannulate, a transverse groove crosses the segments dorsally and at the sides between notopodia and neuropodia; there is also a longitudinal groove middorsally through the first 7 setigerous segments. The ventrum is neatly biannulate and the rings are smooth.

Separation between the thorax and abdomen is externally unmarked except for the change in parapodia of setae to hooks. Lateral organs, present from the first thoracic setigerous segment, are small, partly retracted papillae in the short, transverse groove between notopodia and neuropodia but nearer the former; they are continued posteriorly but are nowhere conspicuous. Nephridial pores, also inconspicuous, are present in intersegmental grooves nearer the dorsal side; the first are present between setigerous segments 11 and 12; they are continued posteriorly through at least the first few abdominal segments. They are not clearly marked, perhaps because none of the individuals seem to be mature; genital apertures have not been distinguished, possibly for the same reason.

Branchiae are retracted on all parapodia except a few in one individual but their approximate distribution can be determined by the presence of a small pore at the superior edge on median and posterior abdominal segment and they are continued posteriorly through a long region.

Uncinal ridges are provided with many hooks in a row, as originally described. The hooks are similar to one another throughout. Their interesting details have been worked out based on neuropodia from a median region but others have been checked for the same details and found to agree. The most conspicuous feature is the nearly complete coalescence of the 3 teeth in the crest so that they can be hardly distinguished unless sharp focus is brought to bear on their tips (pl. 56, fig. 2); otherwise the crest resembles a heavy transverse ridge elevated above the fang. The hood is short but spacious (pl. 56, fig. 1) and has a finely serrated edge. The node is abrupt but shoulder and neck are less developed than in other species of *Dasybranchus* (compare pl. 56, figs. 1, 3; pl. 57, fig. 2).

D. lunulatus inhabits muddy sand shoals in marine or estuarine localities. In life it is deep blood red. It autotomizes readily.

The collections listed above were obtained through the courtesy of the directors of the Bass Biological Laboratory, Englewood, Florida, and the U. S. Fisheries Laboratory, Pivers Island, Beaufort, North Carolina

while the author was a guest at these stations. They are now deposited in the Allan Hancock Foundation.

Distribution.—*D. lunulatus* was originally described from Key West, Florida (Ehlers, 1887, p. 174) from 1-2 fms, and later recorded from Puerto Rico by Treadwell (1901, p. 206). The present records include Lemon Bay, Florida, and Beaufort, North Carolina, in intertidal areas.

***Dasybranchus glabrus* Moore**

Plate 57, Figs. 1, 2

Moore, 1909, pp. 280-281, pl. 9, fig. 58; Treadwell, 1914, p. 212.

Collections.—1025-39 (1); 1040-40 (1); 1193-40 (1); 1264-41 (1); 1297-41 (1); 1299-41 (1); others come from various parts of California including Half Moon Bay south to Ensenada, Lower California (about 12 individuals).

D. glabrus is at once distinguished from other species with which it may occur for having a thoracic region that is smooth except for wrinkles of contraction between the segmental grooves. The branchiae are limited to a posterior abdominal region; they are retractile and emerge from a pore just above the neuropodium; they consist of 2 or 3 short, thick filaments. In this respect, as also in the texture of the thoracic epithelium, the species resembles *D. lunulatus* (see above). The prostomium is broadly rounded at its anterior end much as in *D. platyceps* (pl. 55, fig. 1) and lacks visible eyespots; the nuchal slits are in the usual position at the posterior margin of the prostomium. Color in life is pale red.

Abdominal hooks have a large, translucent hood that fits loosely about the beak; its free margin around the aperture is delicately toothed. The shaft resembles that in other species of the genus; the shoulder is thick and the neck slender. The heavy fang is surmounted by a crest of 3 partly fused teeth with a broad, common base (pl. 57, fig. 1, 2). The shaft is penetrated by fine fibrillae that extend from the base distally to the neck and end abruptly.

D. glabrus is clearly separable from *D. lunulatus* since the first lacks pigmented prostomial eyespots.

D. glabrus has been collected from interstices in a vermetid colony, under stones and from black shales; it may thus be associated normally, with rocky areas rather than soft muds.

Distribution.—Central California south to Guaymas, Mexico; also San Clemente and Santa Cruz Islands off southern California and Cedros Island off Lower California. Its bathymetric range is low intertidal to 65-80 fms.

***Dasybranchus platyceps*, new species**

Plate 55, Figs. 1-5

Collection.—Sonora, Mexico in the Gulf of California, shore (3).

There are fragments of 3 large individuals though none is apparently complete. The pieces are much twisted and turned so that measurements of lengths are only approximate. A long, posterior, tapering end measures 10 cm long for 180 segments. A larger anterior end with thorax and 70 abdominal segments measures 14 mm to the end of the thorax and 43 mm long through 83 segments. Greatest width is about 8 mm in the posterior thoracic region. The segments throughout are very short and broad as though much contracted from preservation. Total number of segments may be well over 200 and the entire length (preserved) may be 6 inches or more.

The thoracic segments are distinctly biannulate, the 2 rings about equally long; parapodial fascicles arise from the posterior ring. The first few abdominal parapodia are likewise biannulate and resemble those in the last thoracic region but farther back in front of the origin of the branchiae, the segments come to be gradually smoother and uniannulate except for short transverse grooves at the sides of the body. In a post-median region the segments are again more or less sharply biannulate and faintly longitudinally ridged.

Separation between thorax and abdomen is not distinct in external view except for the obvious change in parapodia from setal fascicles to long uncinal ridges. There are 13 setigerous segments; each is provided with only pointed setae in both notopodia and neuropodia.

The prostomium is a depressed, broadly rounded lobe; it lacks a palpode and visible eyespots but the nuchal slits may be seen by pushing back the peristomial fold. The peristomium is a long, biannulate ring that is nearly 3 times as long as the first setigerous segment. The proboscis is not everted in any specimen but by dissection it is seen to be coarsely and closely papillated on its proximal half and smooth distally; the separation between the 2 regions is abrupt.

The first setigerous segment is complete with notopodia and neuropodia; a retracted lateral organ is visible between the 2 rami, in a depression and slightly nearer the notopodium. Farther back the parapodial fascicles increase in size and come to be farther apart as the circumference of the thorax increases. Lateral organs are nowhere conspicuous but are larger on the thorax than on the abdomen; they have been located on all segments, between notopodia and neuropodia. In the thorax they are somewhat concealed by folds because they are retracted; in the abdomen, where they are non-retractile, they are visible as transversely elongated papillae in a similar position as in the thorax but slightly behind the uncinal ridge.

Nephridial apertures number about 15 pairs; they are in the segmental grooves about midway between notopodia and neuropodia. The first is present between thoracic setigerous segments 9/10; they are continued posteriorly through anterior abdominal segments at least through the eleventh one. They are subcircular, opaque white patches on the anterior face of segments (pl. 55, fig. 5); it seems likely that they change in character with age or maturity of individuals.

Abdominal notopodia are well separated from each other. Already from the first one they are separated by a distance about half as great as the length of the long notopodial ridge. The distance between the 2 of a pair increases farther back so that the tori are dorsolateral in position. Far back, where the body diminishes in width, the tori come to be shorter but the dorsal ones are still wide apart. Neuropodia are at first very long but well separated from each other midventrally; they are ventrolateral in position. In a far posterior region they also decrease in length and the 2 of a pair approach each other medially. The ridges are only slightly raised above the surface of the body, but are not inflated as in *D. lumbricoides* (see above).

Branchiae are retractile, branched structures. They are first present from the thirteenth segment and continued posteriorly nearly to the end but on the last few slender segments where parapodia are hardly visible, they have not been distinguished. They emerge from a pore immediately above the neuropodial ridge and come to be large, dendritically branched; the first division is dichotomous, resulting in a pair of short main stems; subsequent branching is irregular. Where best developed there may be 30 or more distal filaments.

Abdominal hooded hooks have a thick node and a long slender shaft between it and the base of the hood. Neck and shoulder regions are well

defined in lateral view; the beak consists of a larger basal fang with a smaller secondary fang above it; this is surmounted by a transverse ridge terminating in 3 short denticles (pl. 55, fig. 3). The hood is voluminous and has a large aperture; its margin is only slightly toothed. The pygidium is a large dorsal aperture at the end of the body; it lacks appendages.

D. platyceps is characterized in having branchiae that are dendritically branched and emerge from a pore above abdominal neuropodia; they are continued through a long region, present already from the thirteenth and continued nearly to the end of abdominal segments. The thoracic epithelium is only slightly areolated; the surface epithelium throughout appears nearly smooth under low magnification. Lateral organs are present on all segments. Nephridial apertures number about 15 pairs and are present in posterior thoracic and anterior abdominal segments. Abdominal uncinal ridges are well separated from one another throughout. Hooded hooks have a beak with primary and secondary fangs crowned by a crest of 3 short denticles on a transverse ridge. *D. platyceps* is separable from other species of the genus as indicated in the key above.

The single collection on which this species is based was made by Mr. Steve A. Glassell in May 1941, to whom thanks are hereby extended.

Holotype.—AHF no. 122.

Type locality.—Sonora, Gulf of California, Mexico; intertidal.

Distribution.—Gulf of California, Mexico.

Genus **LEIOCAPITELLA**, new genus

Type **L. glabra**, new species

The thorax and abdomen are not distinctly separable in external view. The thorax consists of 14 or 15 segments, the peristomium or first segment is achaetous and apodous. The second segment has notopodia only; the third to fourteenth segments are provided with fascicles of pointed setae in both notopodia and neuropodia; the fifteenth segment has pointed setae dorsally and long-handled hooks ventrally; thereafter at least to the fifteenth segment parapodia have only long-handled hooks in both rami of parapodia or the superior part of the fifteenth notopodium may continue to have a few pointed setae accompanied by a ridge of hooks. Lateral organs are present on all known segments, located between notopodia and neuropodia; on the thorax they are retractile, on the abdomen

they are stationary, papillae. Nephridial apertures are visible on posterior thoracic segments; they have not been located on abdominal segments. The proboscis has coarse papillae on its proximal half and is smooth distally. Abdominal hooks are hooded; the beak has a major fang with a crest of 3 teeth.

Leiocapitella may be considered intermediate between *Leiochrus* Ehlers and *Pseudocapitella* Fauvel, hence the generic name (see chart). In *Leiochrus* the first setigerous segment is complete with notopodia and neuropodia but the fourteenth segment has both setae and hooks in both rami of parapodia. In *Pseudocapitella* a neuropodium is lacking on the first setigerous segment but pointed setae are continued posteriorly in notopodia through 17 segments. All 3 genera are believed to be abbranchiate.

***Leiocapitella glabra*, new species**

Plate 54, Figs. 1-3

Collections.—1107-40 (1); 1265-41 (1).

The general shape of the body is linear and cylindrical except that the anterior thoracic region is somewhat enlarged. One anterior fragment (1265-41) with thorax and 16 abdominal segments measures 20 mm; another (1107-40) with thorax and 36 abdominal segments measures 51 mm long but it is somewhat macerated. The thoracic epithelium is smooth except for fine striations and wrinkles of contraction but there is no areolation.

The prostomium is small, nearly hemispherical; it is rounded at its anterior end and lacks a palpode. A few small, indistinct and deeply embedded specks on either side and in front of the nuchal slits may represent ocular areas. The nuchal slits have the usual position at the posterior margin of the prostomium. The peristomium or first segment is apodous and about $1\frac{1}{2}$ times as long as the next segment. On the proboscis the separation is abrupt between the proximal papillated region and the smooth epithelial distal one.

The first setigerous segment is provided with notopodia only; they resemble those in the next 13 segments but the size of the fascicles increases gradually, going posteriorly to the middle thoracic region. Neuropodial fascicles are present from the third segment and continued posteriorly through only 12 segments. In one individual (1107-40) the sixteenth segment is provided with only hooded hooks in both notopodia and neuropodia but in the other (1265-41) the notopodium has also a

few pointed setae in the superior part of the fascicle; in other respects the 2 individuals are alike. Abdominal segments are unmarked except for the segmental grooves and the low parapodial ridges.

Lateral organs are visible on both thoracic and abdominal setigerous segments, located between notopodia and neuropodia but slightly nearer the former; they are small, papillar and resemble one another in anterior and posterior regions. Nephridial pores are distinguishable only on the thorax; they occupy a position in the segmental grooves; the first is present between setigerous segments 7 and 8, the last between setigerous segments 14 and 15; they number 8 pairs. None have been distinguished in other parts of the body. No branchial structures have been identified.

In anterior abdominal segments the notopodial tori are short and dorsal in position; they are well separated from each other middorsally and farther back they continue much the same but come to be shorter. Neuropodial tori in the same segments are somewhat longer and ventrolateral in position. Farther back the tori increase in length so that the 2 of a pair approach each other midventrally.

Hooded hooks are similar throughout. The hood is basally attached in the region of the shoulder; its distal aperture is smooth and the margin appears entire. The node is thick and abrupt especially on the back side. The beak has a strong fang and is crowned by 3 well separated teeth arranged in a triangle (pl. 54, fig. 3). The fibrillations of the core are coarse.

Holotype.—AHF no. 123.

Type locality.—1 mile northwest of San Gabriel Bay, Espiritu Santo Island, Gulf of California, Mexico in 20-35 fms, in mud.

Distribution.—Gulf of California and Cedros Island, western side of Lower California in 29-55 fms.

Genus **PROTOCAPITELLA** Berkeley

Type **P. simplex** Berkeley

The thorax and abdomen are indistinctly separable but the separation may be at about the fourteenth or fifteenth segment. Notopodia throughout are provided with only pointed setae; neuropodia have long handled hooks. The prostomium is a plain, rounded lobe with weakly developed eyespots and a pair of nuchal slits at its posterior margin. Branchiae are present as simple, palmately branched filaments in a posterior abdominal region, they originate from the surface epithelium adjacent to the notopodia. Lateral organs are seemingly absent. Nephridia are limited to 2

pairs in the thorax. Abdominal hooks are unusual in that they lack a hood and the crest has several rows of transverse teeth (pl. 57, fig. 4). The proboscis is a voluminous sack that appears to be thin and epithelial throughout. The pygidium lacks appendages.

This genus remains known through a single species (see below); its phylogenetic relations with other genera are doubtful since it departs widely from other capitellid genera in several important respects.

Protocapitella simplex Berkeley

Plate 57, Figs. 3, 4

Berkeley, 1932, pp. 669-670, figs. 1-4.

Collections.—1477-42 (1), 1491-42 (1), 1492-42 (1).

Only 3 individuals are in the collections; one is complete and the others are nearly so; they have large eggs in the body cavity hence are perhaps nearly mature. Total length is only 20 mm as originally described; the number of segments is 63; next to *Capitita ambiseta* (see above) this is one of the smallest of known capitellids. The general appearance is slender and cylindrical; it is translucent to pale (preserved).

The prostomial lobe resembles that of a lumbrinerid more nearly than that of a capitellid since it is broadly conical and not covered by the peristomium; the nuchal slits are inconspicuous at its posterior margin. There are 4 eyes in trapezoidal arrangement in front of the nuchal slits. Each consists of a minute, embedded dark speck; the anterior pair is slightly larger and a little farther apart than the posterior pair. They may be seen by slightly depressing the prostomial lobe.

The peristomium is unusually prolonged as first described; its surface is smooth and it lacks parapodial parts. The proboscis is not everted in any individual. By dissection it is seen to consist of a spacious, wrinkled sack with epithelial walls. The thin-walled oesophagus seems to extend through about 14 segments, thus marking the possible separation between thorax and abdomen.

The second (first setigerous) segment is complete with notopodial fascicles and neuropodial uncinigerous ridges; this arrangement continues throughout the body. Notopodia are dorsolateral to lateral in position; the 2 of a pair are widely separated from each other middorsally. Neuro-podia are lateral to ventrolateral in position and only a short distance from their respective notopodia. No lateral organs have been distinguished on any segments.

Branchiae are first present from the thirty-second setigerous segment and continued posteriorly to the fourth last segment. They arise from the surface epithelium, within and in front of the notopodial fascicles; they consist of slender, digitate processes at most 3 or 4 lobed and are probably not retractile.

Nephridia may number only 2 pairs; they lie in setigerous segments 5 to 7; the external aperture of the first pair appears to be associated with the fifth, the second pair with the sixth, neuropodium; the external apertures in these individuals are not enlarged as originally described (Berkeley, 1932, p. 669); they may function as genital pores and enlarge only at sexual maturity. Large elongated eggs can be seen through the body wall from the sixth or eighth setigerous segment to the midbranchial region.

The neuropodial hooks are remarkable in several respects when compared with similar structures in other members of this family. There is no indication of a hyaline hood nor place of its attachment. The shaft is short and strong with a conspicuous node (pl. 57, figs. 3, 4) and terminates in a short distal portion surmounted by a long fang and several series of transverse teeth. There are no shoulder and neck as in other species examined. The crest consists of 4 rows of teeth but the uppermost series is to be seen only in lateral view (pl. 57, fig. 3) or by examining the hook from its distal end. The fibrillations are coarse and continued conspicuously through the shaft and into the beak.

The body terminates posteriorly in a slightly depressed, broadly rounded lobe above which the anal aperture opens; there are no caudal appendages.

Distribution.—The 3 individuals on which the above account is based were collected at Agate Beach, under Yaquina Head light, along a rocky beach, and at Lighthouse Beach reef and bight, Coos County, Oregon, among eelgrass root masses in June, 1942. The previous record is Wreck Bay, west side of Vancouver Island, British Columbia, among roots of eelgrass (Berkeley, 1932).

Genus ANOTOMASTUS, new genus

Type *A. gordiodes* (Moore)

The body is long, slender and linear. It consists of the thorax of 18 or 19 segments and a longer abdominal region with many segments. The first segment or peristomium is achaetous. The second or first setigerous, segment is provided with notopodia only. The third to seventeenth or

eighteenth segments have only pointed setae in notopodia and neuropodia. The next segment is transitional; its notopodium is provided with only pointed setae but its neuropodium has only long-handled hooks or also a few pointed setae (pl. 58, fig. 1) (see chart). Abdominal segments are provided with only long-handled hooded hooks of a single kind. Branchiae are present in far posterior segments and consist of a few palmately divided filaments that arise from the posterior rim of the notopodium; they are seemingly non-retractile. Lateral organs are present on all thoracic setigerous segments and perhaps on all abdominal segments; they occupy a position nearly midway between the dorsal and ventral branches of parapodia. Nephridial papillae are present in some thoracic segments and occupy a position in the segmental furrow; they have not been detected in abdominal segments.

Anotomastus is characterized by its high thoracic segmental count; pointed setae are continued posteriorly through 17 or 18 segments; it has notopodial, branched branchiae in far posterior segments. A single species is known (see below).

***Anotomastus gordiodes* (Moore), new combination**

Plate 58, Figs. 1-6

Eunotomastus gordiodes Moore, 1909, pp. 278-279, pl. 9, fig. 56.

Collections.—1450-42 (6); 1451-42 (2); others from Mission and Newport Bays and Anaheim Slough, southern California and questionably some from Bodega Bay, central California; intertidal.

The prostomium is elongate and broadly rounded in front; it lacks a true palpode such as is present in some capitellids. The posterior margin shows a pair of distinct nuchal slits. Each side has an oval, oculate area that is more or less faded in some individuals; it consists of 6 to 15 reddish brown specks of irregular sizes in front of the nuchal slits. The proboscis, everted in some individuals, is a subglobular sack that is smooth on its distal half but has coarse papillae on its proximal half; when seen in profile each papilla is seen to terminate distally in a posteriorly directed, hyaline hook.

The epithelium of the thorax is nearly smooth except for transverse wrinkles of contraction; there are no areolations. The abdominal region is similarly smooth except for the glandular, parapodial tori and the branchiae in a far posterior region.

Lateral organs are small but can be seen already from the first setigerous segment. They are located nearly midway between notopodia and

neuropodia but slightly nearer the former; in abdominal segments they are somewhat larger but they continue to occupy a position between the dorsal and ventral branches of the parapodia.

Parapodia are inconspicuous in the thorax except for the spreading setal fascicles; in the abdomen they are conspicuous largely because of their swollen glandular bases. In the anterior half of the thorax they are about midway along the segmental length; farther back they move progressively back so that they come to lie on the posterior third of the segmental length. In branchial segments the tori are located just in front of the segmental grooves.

The second, or first setigerous, segment is provided with a pair of small notopodial fascicles; the next 15 or 16 segments are complete with both notopodia and neuropodia. The following one is transitional in that the neuropodium is slightly glandular and contains both pointed setae and long-handled hooks or only hooded hooks, resembling those farther back. This difference between individuals is not correlated with sex or with locality since in some instances (station 1450-42) individuals of both kinds occur in a single collection. The pointed setae in this transitional segment number only 2 or 3; they are located in the superior part of the fascicle (see chart).

Nephridial apertures are not conspicuous but can be distinguished in the segmental furrows, already present between the seventh and eighth segment; they are continued posteriorly through segments 19 and 20, or after the transitional one; they number 12 or 13 pairs. In some individuals the external pore is not visible before the eighth segment so that the total number may be diminished by one. Nephridia have not been distinguished in the abdomen.

Abdominal tori are comparatively conspicuous largely because of their thickened, glandular ridges. The first few pairs of notopodial tori are separated from each other middorsally but by the fourth or fifth pairs they appear to meet each other middorsally. They are well developed throughout the middle and posterior segments but far back they decrease in length and size and are more or less restricted to the dorsoectal portion of the segment. Neuropodial tori are similarly well developed, their length even greater than that of the notopodial ones; midventrally the 2 of a pair are separated by a smooth space.

Branchiae are limited to posterior segments and are continued to the posterior end. They consist of tufts of 6 to 12 palmately divided filaments and arise from the posterior flange of the notopodial ridge. The

posterior end of the body terminates in a characteristic pygidium, with a pair of thicker, longer filaments ventrally and 4 or 5 slenderer, shorter filaments at the sides.

Hooded hooks are disposed in single series of 8 to 15 where best developed. Individually they are unique for their short, thick stalk and compact beaked end and they have a broad, though short, hood. The distal end terminates in a strong fang that is crowned by a single large tooth over which there are 5 smaller teeth arranged in 2 rows of 2 each and a smaller one at the outer edge.

The tube is thin and consists of a mucoid membrane externally covered with fine sand grains. It adheres closely to the body of the inhabitant and is perhaps readily reconstructed when removed from the living individual.

A. gordiodes was originally, though with some doubt, assigned to the genus *Eunotomastus* McIntosh (Moore, 1909, p. 278). The status of the genus *Eunotomastus* remains in doubt (see below) but since the fragmentary description states that "the dorsal bristles are continued (in four segments) after the commencement of hooks," it is clearly separable from the species described above. The original and only known account of *A. gordiodes* was based on a collection from San Diego, California. Although there are some variations between it and the above account, the differences may be due to interpretations rather than actual differences. The prostomium was described as a minute blunt palpode with a pair of nuchal organs. The presence of eyes was not mentioned but they might have been faded. Eyes have been distinguished in all the individuals examined but are darker in some individuals than in others. The thorax was described with 17 setigerous segments and all were said to have both notopodia and neuropodia. I have been unable to locate a neuropodium on the first setigerous segment; also, the eighteenth or also the nineteenth segment has setae but in the last of these the neuropodium is uncinigerous, partaking in its character of abdominal tori. Hooded hooks were first shown with a thick shoulder terminating in a thick fang and 3 superimposed teeth surrounded by a short, inflated hood. I believe, however, that the details, shown in plate 57, figs. 2 and 3, are not at variance with those in the original account but merely amplify the known facts.

Anotomastus gordiodes inhabits mud flats in low, intertidal zones.

Distribution.—This has been taken in Mission and Newport Bays, and Anaheim Slough in southern California; another record, Bodega Bay, central California is questionable. The only other known record is San Diego, California (Moore, 1909). It is intertidal.

Genus **EUNOTOMASTUS** McIntoshType **E. grubei** McIntosh

This genus has remained unknown except through a brief original description based on a collection off Bermuda in 435 fms (McIntosh, 1885, p. 388). The description is brief and obscure in some respects. Regarding the anterior region, it is said that "a few of the anterior bristle tufts [fascicles of pointed setae?] are absent, but about 16 pairs appear to have been present." Also, "the dorsal bristles are continued (in 4 segments) after the commencement of the hooks . . . The second region of the body abdomen is not differentiated . . . as in the ordinary form." From the foregoing it seems that the type of the genus is characterized in having 16 segments with pointed setae and 4 segments in which notopodia are provided with both hooks and setae. The details of the prostomium, accurate distribution of setae and hooks, lateral organs and nephridia are not known. Eisig (1887, p. 873) considered the genus doubtful since it is incompletely known. Until topotypes can be examined it may be desirable to regard the genus and species questionable.

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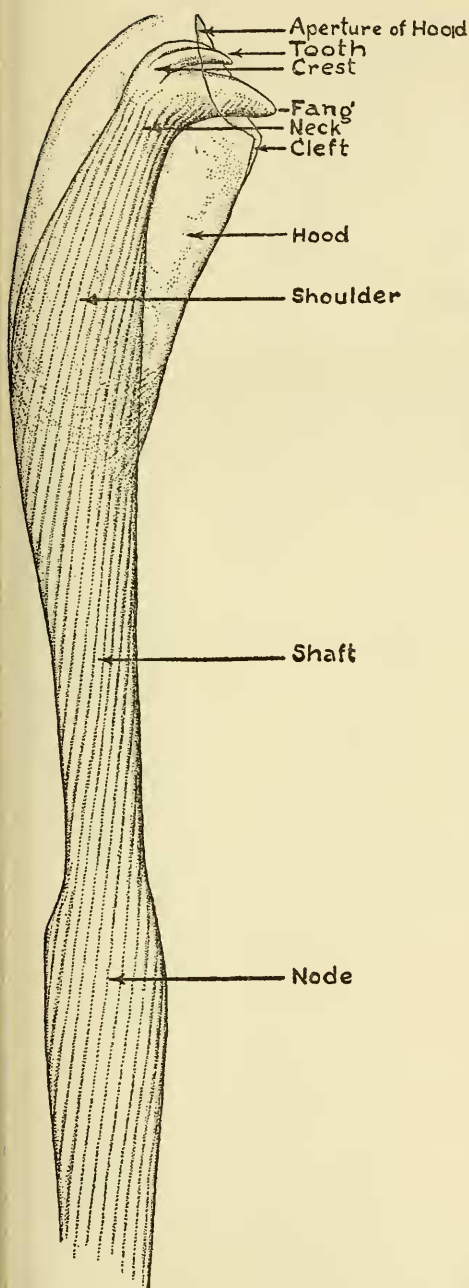
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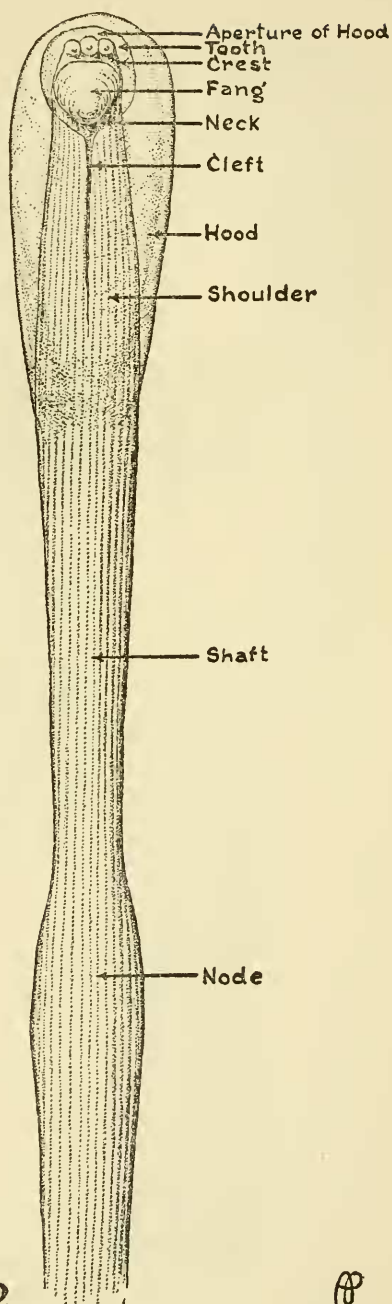
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PLATE 43

Figures 1-2. *Capitella capitata*: Fig. 1, hooded hook in lateral view, with names of parts, x1890; Fig. 2, hooded hook in frontal view, with names of parts, x1890.



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PLATE 44

Figures 1-6, *Capitella ovincola*, new species: Fig. 1, last 4 thoracic and first 2 abdominal segments of male individual, in dorsal view, x 16; Fig. 2, genital hook from eighth segment, x 100; Fig. 3, genital hook from ninth segment from same individual, x 100; Fig. 4, abdominal hook in frontal view, x 1250; Fig. 5, abdominal hook in lateral view, x1250; Fig. 6, twenty-first and twenty-second segments in right dorsolateral view, x 18.

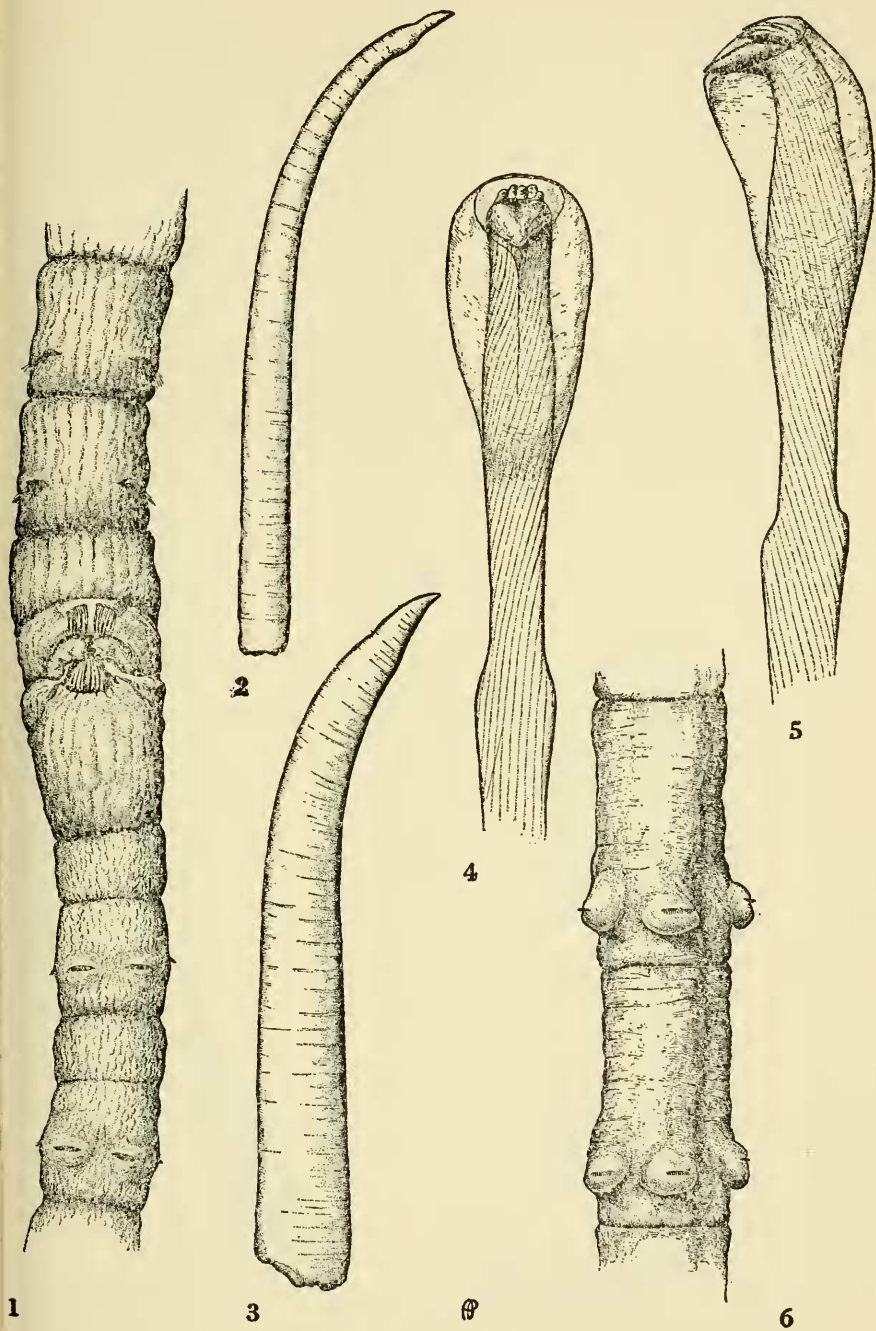
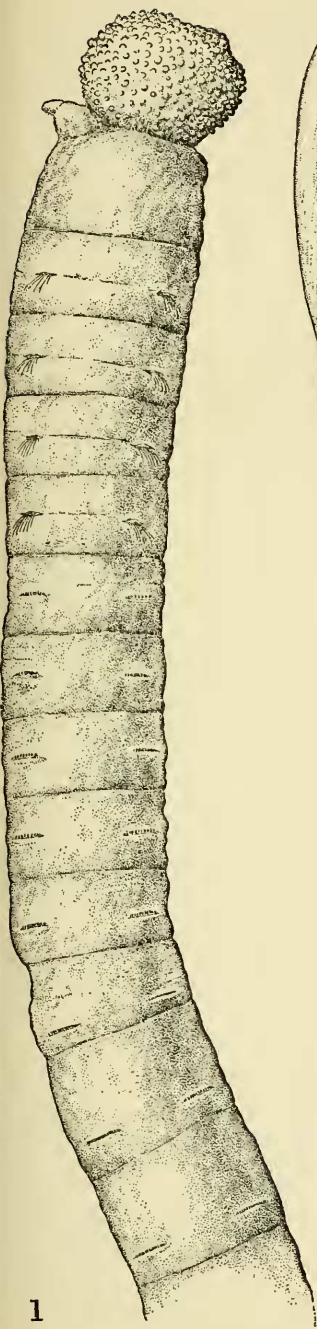
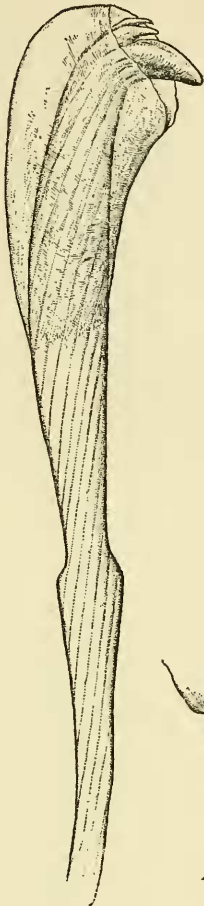


PLATE 45

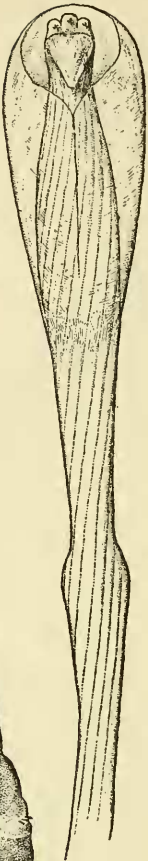
Figures 1-4, *Capitita ambiseta*, new genus and species: Fig. 1, anterior end including thorax and some abdominal segments, in right lateral view, $\times 66$; Fig. 2, hooded hook from abdomen, in lateral view, $\times 2947$; Fig. 3, hooded hook in frontal view, $\times 2947$; Fig. 4, posterior end with caudal appendage, in right lateral view, $\times 170$.



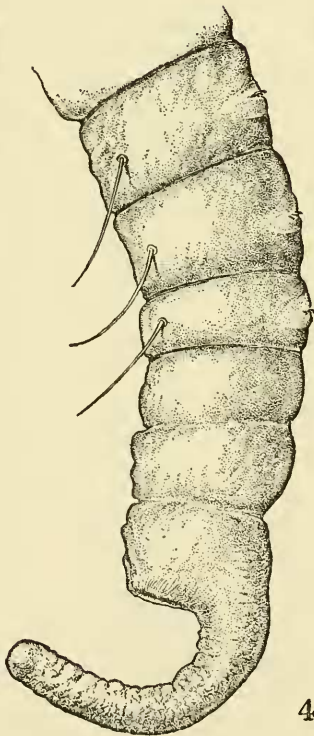
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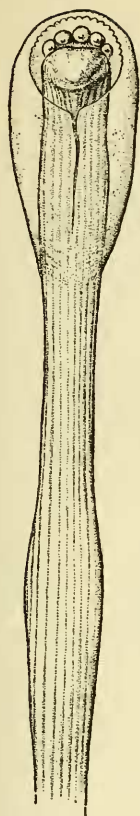
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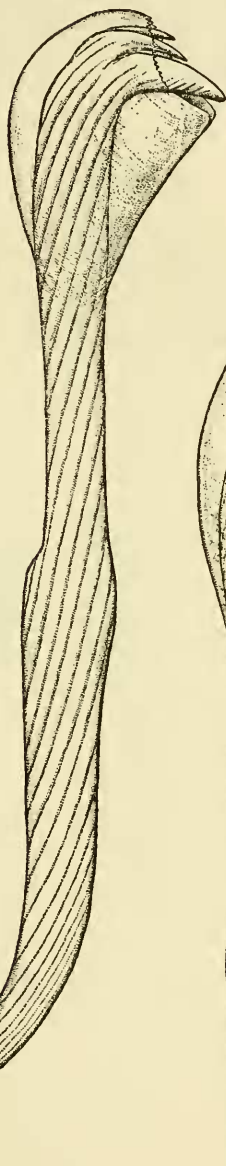
PLATE 46

Figures 1-2, *Notomastus (Clistomastus) lineatus*: Fig. 1, hooded hook in frontal view, x 2353; Fig. 2, hooded hook in lateral view, x 2353.

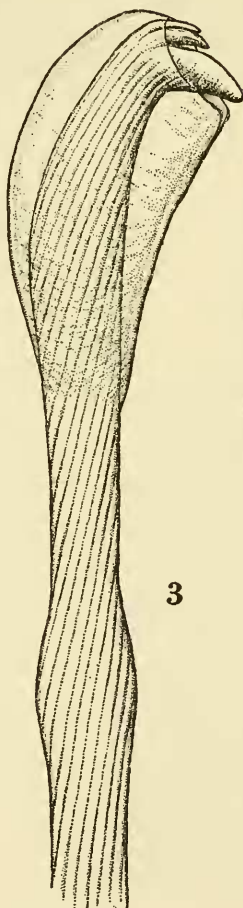
Figures 3-4, *Mediomastus californiensis*: Fig. 3, hooded hook in lateral view, x 2800; Fig. 4, hooded hook in frontal view, x 2800.



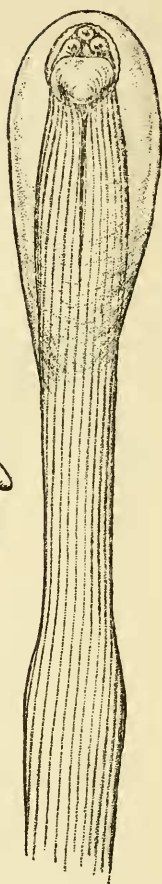
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PLATE 47

Figures 1-5, *Notomastus (Clistomastus) tenuis*: Fig. 1, anterior end in right lateral view, x 14; Fig. 2, hooded hook from anterior abdominal segment in frontal view, x1700; Fig. 3, hooded hook in lateral view, x1700; Fig. 4, prostomium with eyespots and nuchal slits, in dorsal view, x 56; Fig. 5, four abdominal segments in right ventrolateral view, x 31.

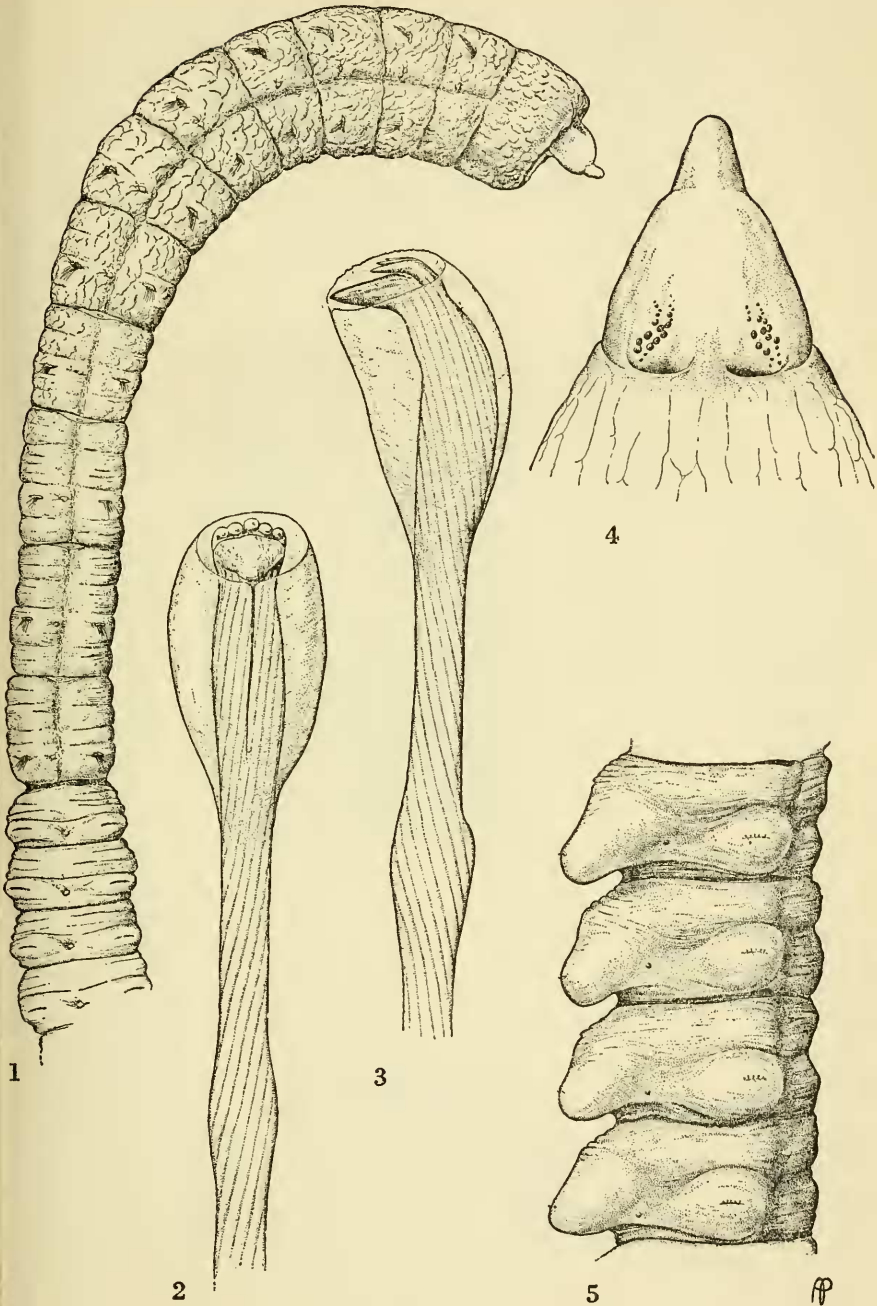
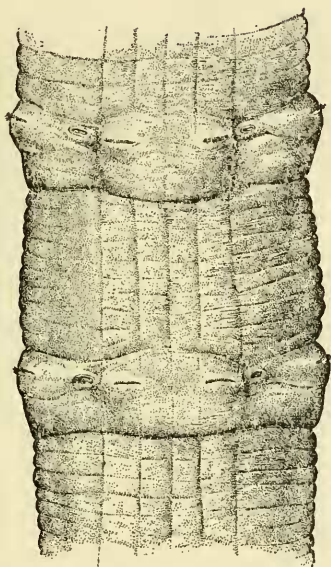
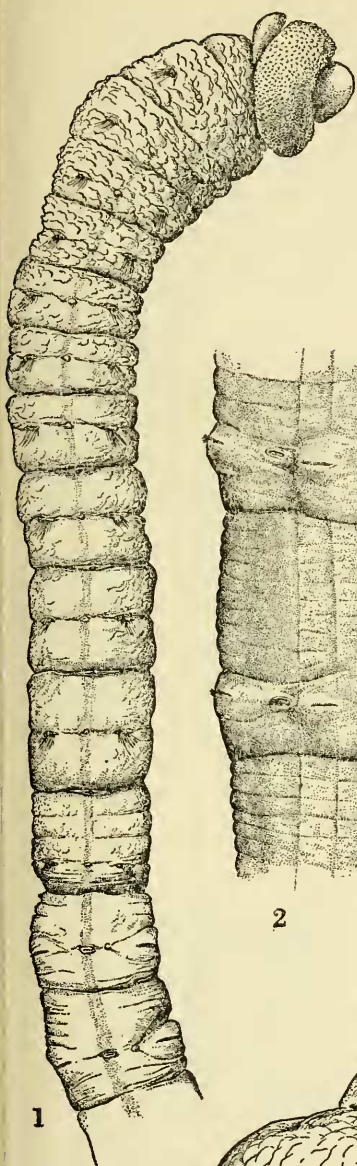


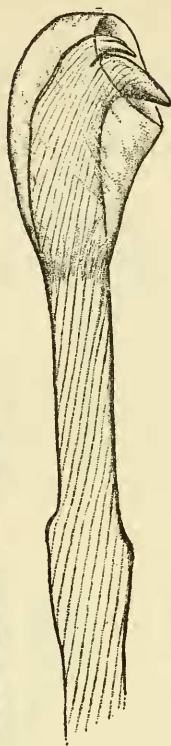
PLATE 48

Figures 1-5, *Notomastus (Clistomastus) hemipodus*, new species:

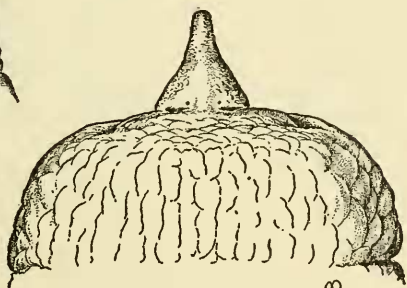
Fig. 1, anterior end including thorax and first 2 abdominal segments, in right lateral view, proboscis partly everted, x 15; Fig. 2, median abdominal segments in dorsal view, x 29; Fig. 3, prostomium and peristomium, in dorsal view, showing eyespots and nuchal slits, x 34; Fig. 4, hooded hook from median abdominal segment, in lateral view, x 1631; Fig. 5, hooded hook in frontal view, x 1631.



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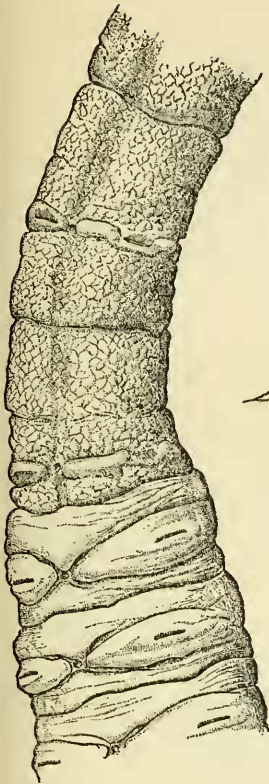
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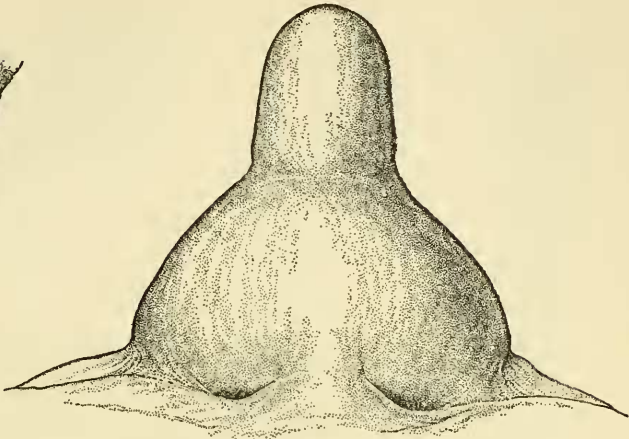
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PLATE 49

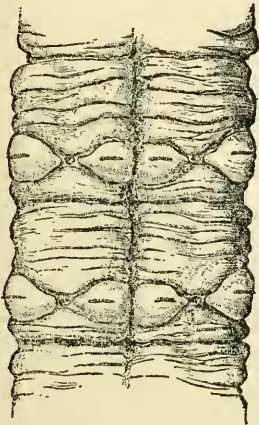
Figures 1-5, *Notomastus (Clistomastus) luridus*: Fig. 1, last 2 thoracic and first 2 abdominal segments in right lateral view, x 20; Fig. 2, prostomium in dorsal view, showing palpode and nuchal slits, x 110; Fig. 3, median abdominal segments in dorsal view, x 22; Fig. 4, abdominal hook in lateral view, x 1350; Fig. 5, abdominal hook in frontal view, x 1350.



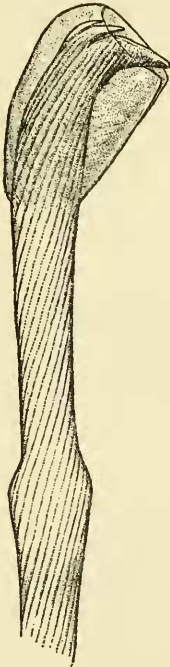
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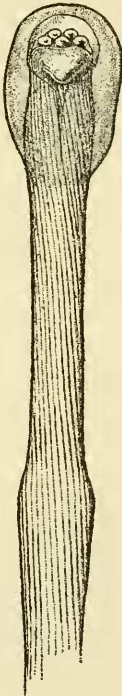
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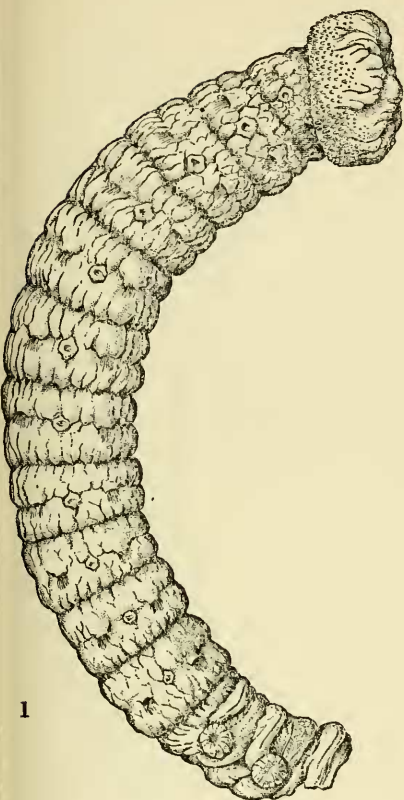


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PLATE 50

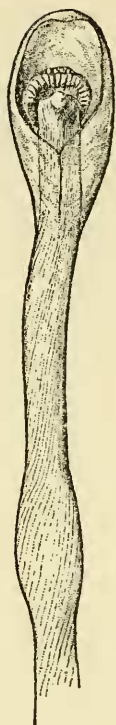
Figures 1-6, *Notomastus magnus*, new species: Fig. 1, anterior end of mature female, including thorax and 2 abdominal segments, in lateral view, proboscis partly everted, x 2.7; Fig. 2, hooded hook from a posterior segment in lateral view, x 900; Fig. 3, hooded hook in frontal view, x 900; Fig. 4, prostomium and part of peristomium in dorsal view, showing palpode and nuchal slits, x 12; Fig. 5, fourth and fifth abdominal segments of mature female individual showing large genital apertures posterior to the papillar lateral organs, in dorsal view, x 6.3; Fig. 6, three far posterior segments, in dorsolateral view, branchiae everted, x 6.3.



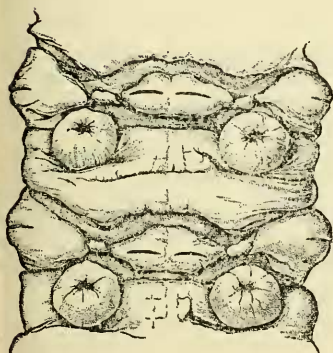
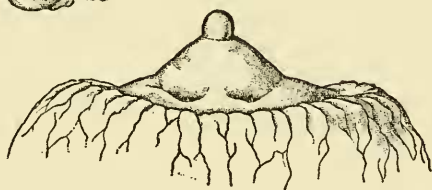
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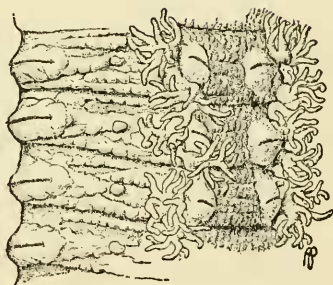
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PLATE 51

Figures 1-5, *Notomastus lobatus*, new species: Fig. 1, last 3 thoracic and first 7 abdominal segments, in right lateral view, x 4.6; Fig. 2, abdominal hooded hook in lateral view, x 1570; Fig. 3, abdominal hooded hook in frontal view, x 1570; Fig. 4, abdominal segments 41 to 48 in ventrolateral view, x 12.8; Fig. 5, prostomial lobe in dorsal view, x 12.8.

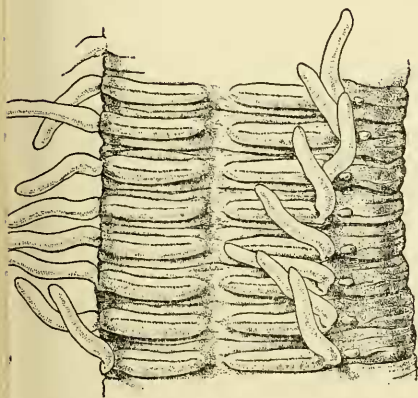
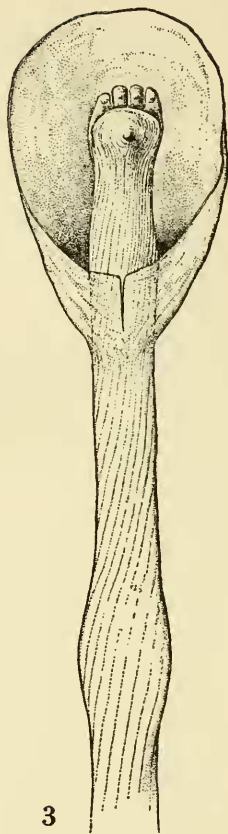
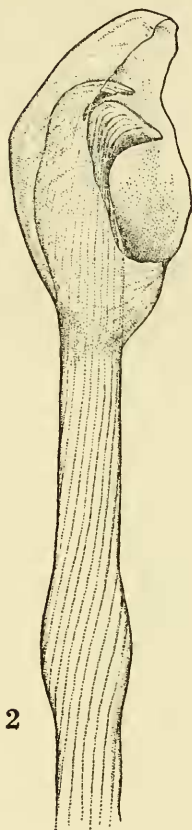
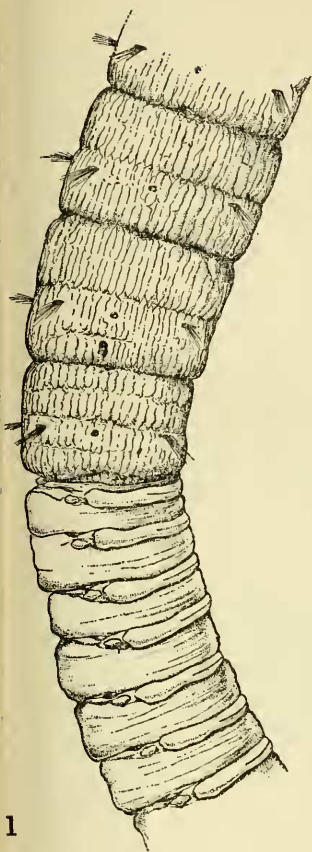
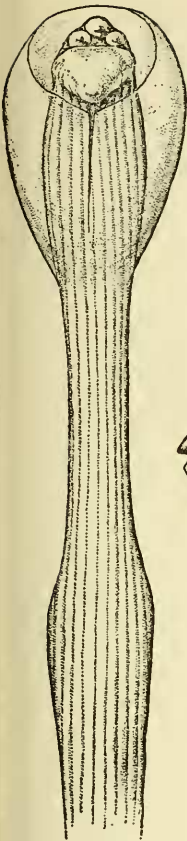
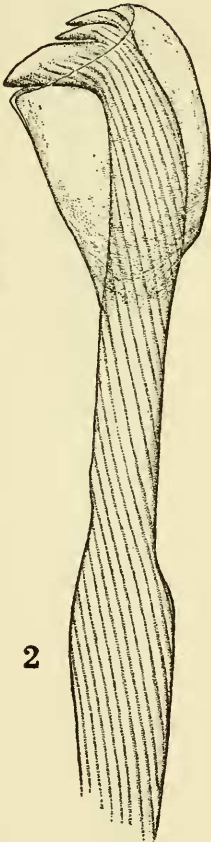


PLATE 52

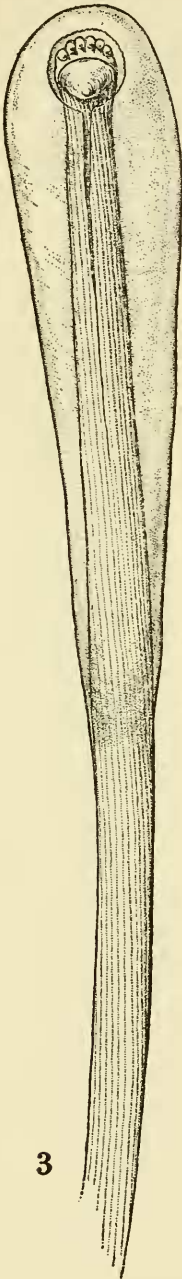
Figures 1-4, *Heteromastus filiformis*: Fig. 1, abdominal hook in frontal view, x 2546; Fig. 2, abdominal hook in lateral view, x 2546; Fig. 3, distal end of long-handled, thoracic hook, in frontal view, x 1533; Fig. 4, distal end of long-handled, thoracic hook, in lateral view, x 1533.



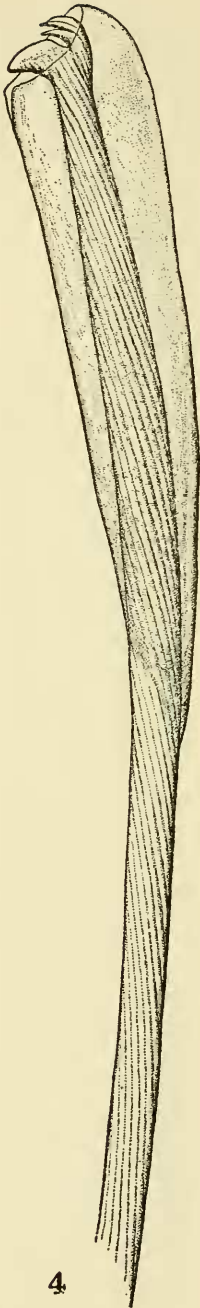
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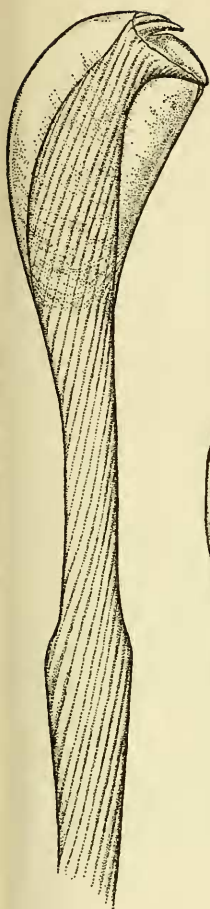
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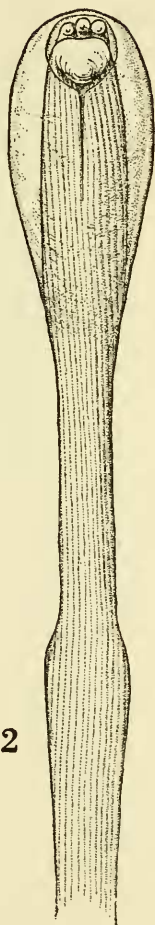
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PLATE 53

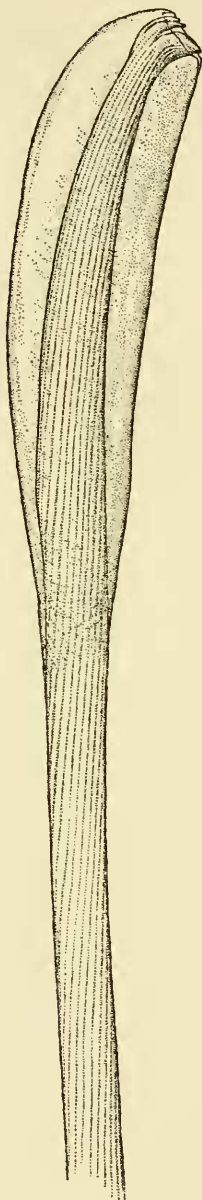
Figures 1-4, *Heteromastus flobranchus*: Fig. 1, abdominal hook in lateral view, x 1540; Fig. 2, abdominal hook in frontal view, x 1540; Fig. 3, distal end of long-handled, thoracic hook, in lateral view, x 1264; Fig. 4, distal end of long-handled, thoracic hook, in frontal view, x 1264.



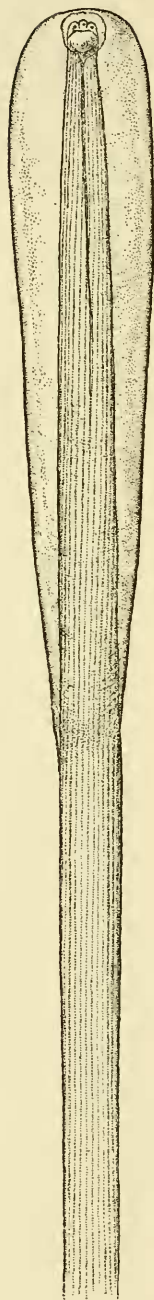
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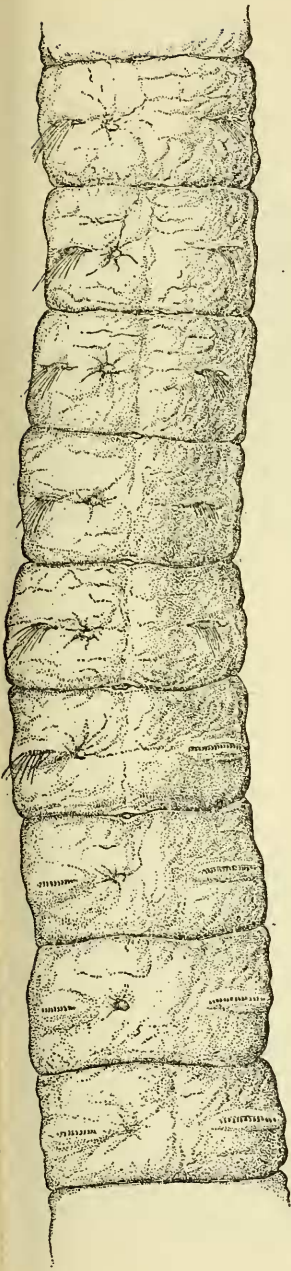
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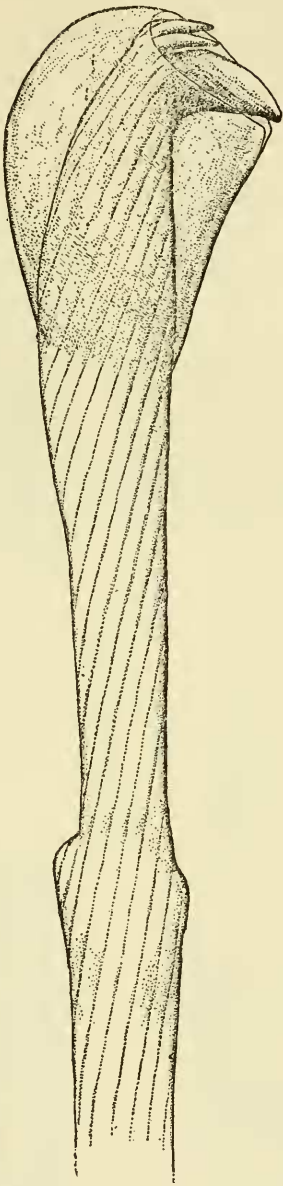
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PLATE 54

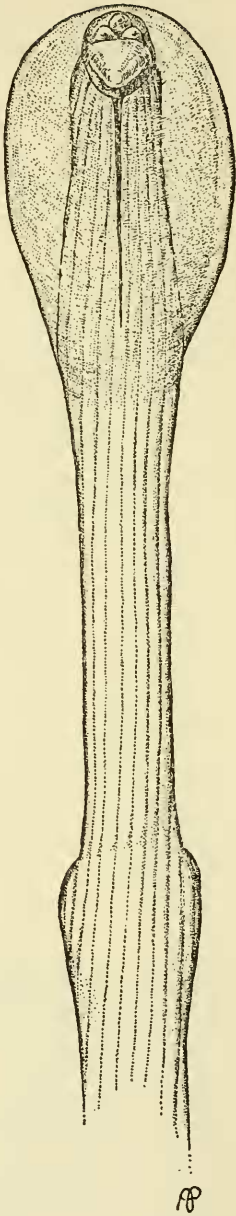
Figures 1-3, *Leiocapitella glabra*, new genus and species: Fig. 1, tenth to eighteenth segments, showing posterior thoracic transitional fifteenth, and anterior abdominal segments, in right lateral view, x 23; Fig. 2, abdominal hook in lateral view, x 2385; Fig. 3, abdominal hook in frontal view, x 2385.



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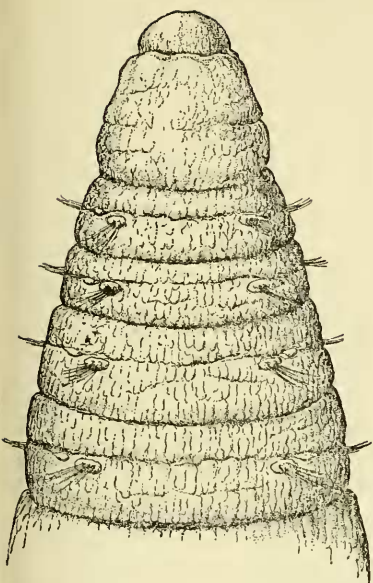
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PLATE 55

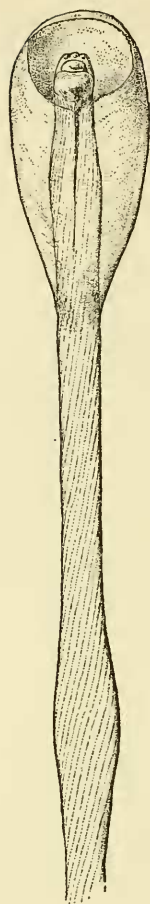
Figures 1-5, *Dasybranchus platyceps*, new species: Fig. 1, anterior end including prostomium, peristomium and 4 thoracic setigerous segments, in dorsal view, x 9; Fig. 2, hooded hook in lateral view, x 931; Fig. 3, hooded hook in frontal view, x 931; Fig. 4, anterior branchial region from right side, in three-quarter view, branchiae wholly to partly everted, the row of papillar lateral organs marks the right lateral line, x 8; Fig. 5, last 5 thoracic and first 7 abdominal segments, in left lateral view, x 7.5.



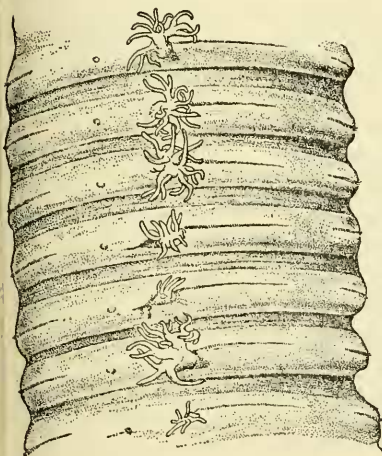
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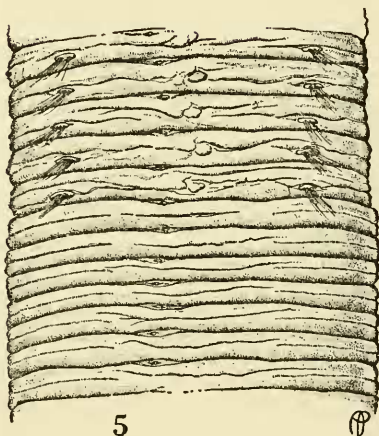
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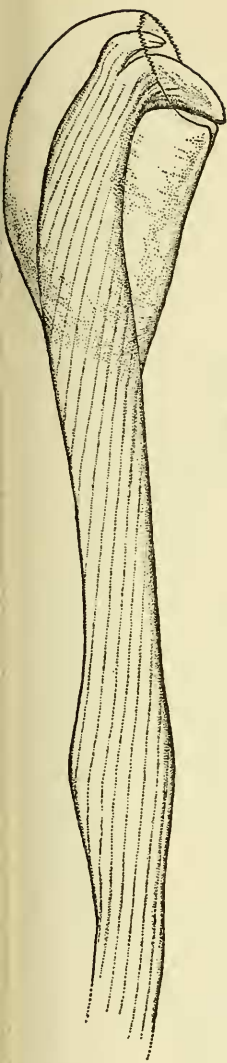
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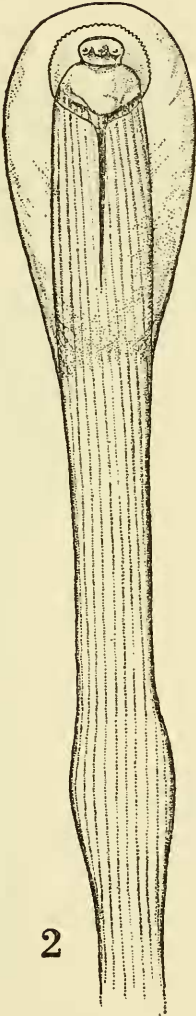
PLATE 56

Figures 1-2, *Dasybranchus lunulatus*: Fig. 1, abdominal hook in lateral view, x 1916; Fig. 2, abdominal hook in frontal view, x 1916.

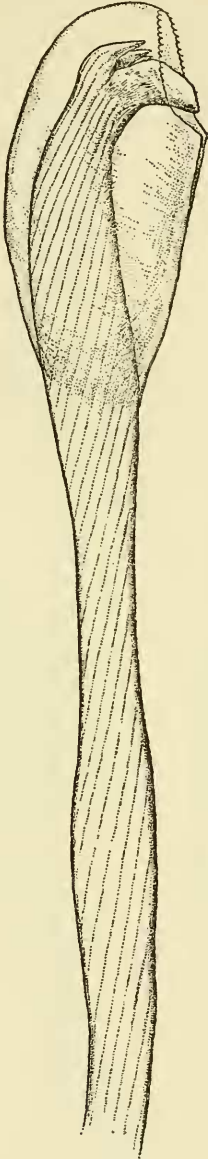
Figures 3-4, *Dasybranchus lumbricoides*: Fig. 3, abdominal hook in lateral view, x 1543; Fig. 4, abdominal hook in frontal view, x 1543.



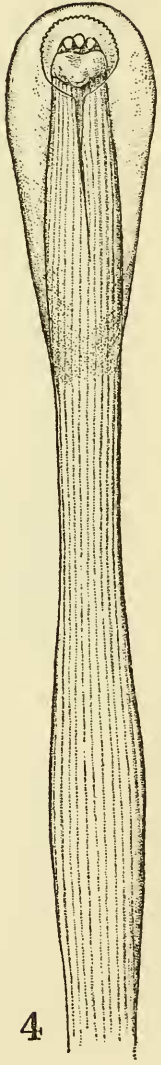
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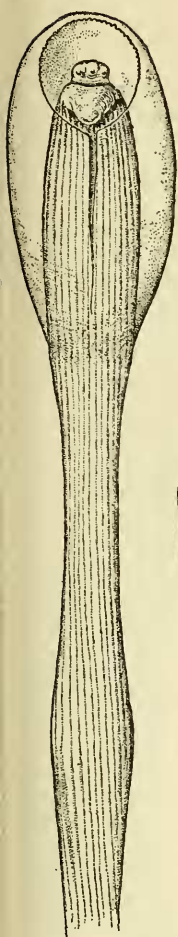


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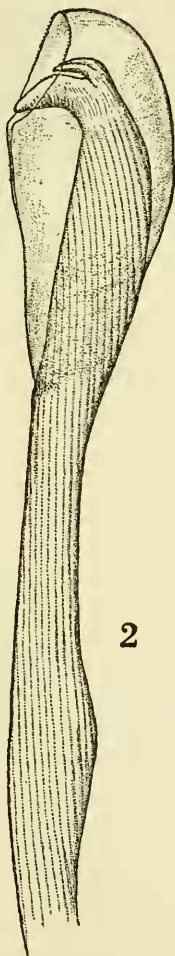
PLATE 57

Figures 1-2, *Dasybranchus glabrus*: Fig. 1, abdominal hook in frontal view, x 1188; Fig. 2, abdominal hook in lateral view, x 1188.

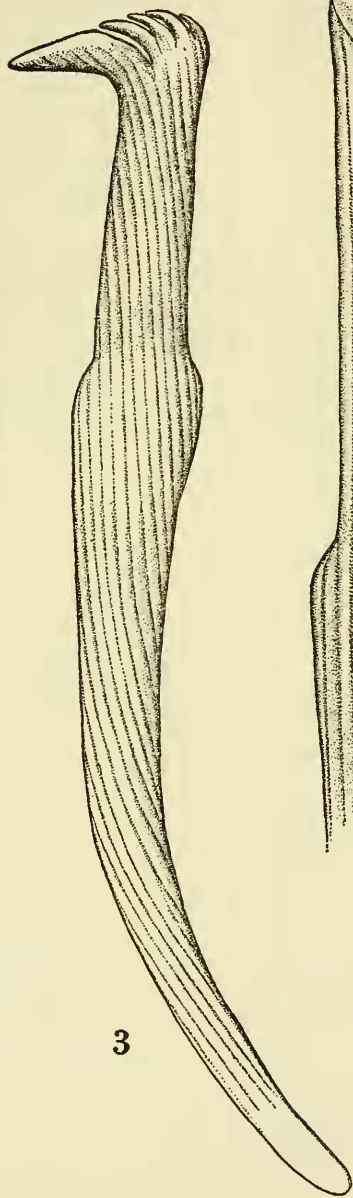
Figures 3-4, *Protocapitella simplex*: Fig. 3, abdominal hook in lateral view, x 2592; Fig. 4, abdominal hook in frontal view, x 5184.



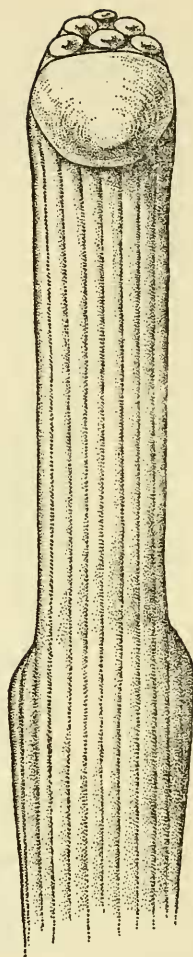
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PLATE 58

Figures 1-6, *Anotomastus gordiodes* (Moore), new combination:
Fig. 1, last 3 thoracic and first 2 abdominal segments, in right lateral view, x 18; Fig. 2, abdominal hook in frontal view, x 1500; Fig. 3, abdominal hook in lateral view, x 1500; Fig. 4, prostomium with eyespots and nuchal slits, and peristomium, in dorsal view, x 30; Fig. 5, pygidium showing anal aperture and elongate processes, in dorsoposterior view, x 65; Fig. 6, three branchial segments from a posterior region, showing notopodial tori and filamentous branchiae, in dorsal view, x 45.